ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

B.E. CIVIL ENGINEERING (PART TIME)

REGULATIONS – 2017

CURRICULA AND SYLLABI I - VII SEMESTERS

SEMESTER I

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTPH7101	Physics for Civil Engineering	3	0	0	3
3.	PTCY7101	Chemistry for Civil Engineering	3	0	0	3
4.	PTGE7151	ComputingTechniques	3	0	0	3
5.	PTCE7101	Strength of Materials I	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER II

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7252	Transforms and Partial Differential Equations	3	0	0	3
2.	PTAG7201	Engineering Geology	3	0	0	3
3.	PTCE7201	Fluid Mechanics	3	0	0	3
4.	PTCE7202	Plane and Geodetic Surveying	3	0	0	3
5.	PTCE7203	Strength of Materials II	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER III

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTGE7153	Environmental Science and Engineering	3	0	0	3
2.	PTCE7301	Highway Engineering	3	0	0	3
3.	PTCE7302	Soil Mechanics	3	0	0	3
4.	PTCE7303	Structural Analysis I	3	0	0	3
PRACTICAL						
5.	PTCE7311	Plane and Geodetic Surveying Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER IV

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTCE7401	Applied Hydraulic Engineering	2	2	0	3
2.	PTCE7402	Design of Reinforced Cement Concrete Structures	3	0	0	3
3.	PTCE7403	Railways, Airports and Harbour Engineering	3	0	0	3
4.	PTCE7404	Structural Analysis II	3	0	0	3
5.	PTCE7405	Water Supply Engineering	3	0	0	3
		TOTAL	**14**	**2**	**0**	**15**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTCE7501	Design of Steel and Timber Structures	3	0	0	3
2.	PTCE7502	Foundation Engineering	3	0	0	3
3.	PTCE7503	Irrigation Engineering	3	0	0	3
4.	PTCE7504	Wastewater Engineering	3	0	0	3
5.		Elective I	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTCE7601	Estimation, Costing and Valuation Engineering	3	0	0	3
2.	PTCE7602	Ground Improvement Techniques	3	0	0	3
3.	PTCE7603	Structural Design and Drawing	2	0	2	3
4.		Elective II	3	0	0	3
5.		Elective III	3	0	0	3
		TOTAL	**14**	**0**	**2**	**15**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMG7751	Principles of Management	3	0	0	3
2.	PTCE7701	Structural Dynamics and Earthquake Engineering	3	0	0	3
3.		Elective IV	3	0	0	3
PRACTICAL						
4.	PTCE7711	Project Work	0	0	9	6
		TOTAL	**9**	**0**	**9**	**15**

TOTAL : 104 CREDITS

ELECTIVES FOR CIVIL ENGINEERING*

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTGE7071	Disaster Management	3	0	0	3
2.	PTGE7072	Engineering Ethics and Human Values	3	0	0	3
3.	PTGE7073	Human Rights	3	0	0	3
4.	PTGE7074	Total Quality Management	3	0	0	3
5.	PTGE7075	Intellectual Property Rights	3	0	0	3
6.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
7.	PTAI7001	Hydrology and Water Resources Engineering	3	0	0	3
8.	PTAI7002	Integrated Water Resources Management	3	0	0	3
9.	PTAI7003	Participatory Water Resources Management	3	0	0	3
10.	PTCE7001	Air Pollution and Control Engineering	3	0	0	3
11.	PTCE7002	Cartography	3	0	0	3
12.	PTCE7003	Coastal Engineering	3	0	0	3
13.	PTCE7004	Computer aided design of Structures	3	0	0	3
14.	PTCE7005	Concrete Technology	3	0	0	3
15.	PTCE7006	Design of Plate and Shell Structures	3	0	0	3
16.	PTCE7007	Design of Prestressed Concrete Structures	3	0	0	3
17.	PTCE7008	Digital Cadastre	3	0	0	3
18.	PTCE7009	Environmental and Social Impact Assessment	3	0	0	3
19.	PTCE7010	Geo-Environmental Engineering	3	0	0	3
20.	PTCE7011	Geographic Information System	3	0	0	3
21.	PTCE7012	Geoinformatics Applications for Civil Engineers	3	0	0	3
22.	PTCE7013	Groundwater Engineering	3	0	0	3
23.	PTCE7014	Industrial Structures	3	0	0	3
24.	PTCE7015	Industrial Wastewater Engineering	3	0	0	3
25.	PTCE7016	Introduction to Soil Dynamics and Machine Foundations	3	0	0	3
26.	PTCE7017	Maintenance, Repair and Rehabilitation of Structures	3	0	0	3
27.	PTCE7018	Municipal Solid Waste Management	3	0	0	3
28.	PTCE7019	Pavement Engineering	3	0	0	3
29.	PTCE7020	Power Plant Structures	3	0	0	3
30.	PTCE7021	Prefabricated Structures	3	0	0	3
31.	PTCE7022	Rock Engineering	3	0	0	3
32.	PTCE7023	Tall Structures	3	0	0	3
33.	PTCE7024	Total Station and GPS Surveying	3	0	0	3
34.	PTCE7025	Traffic Engineering and Management	3	0	0	3
35.	PTCE7026	Transport and Environment	3	0	0	3
36.	PTCE7027	Transportation Planning and Systems	3	0	0	3
37.	PTCE7028	Urban planning and Development	3	0	0	3
38.	PTCE7029	Water Resources Systems Engineering	3	0	0	3

PTMA7151 **APPLIED MATHEMATICS** **L T P C**

(Common to all branches of B.E / B.Tech (PT) Programmes) **3 0 0 3**

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES 9

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION 9

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS 9

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUT COMES :

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.

4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

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PTPH7101 PHYSICS FOR CIVIL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the principles of physics for civil engineering applications such as acoustical, thermal, air conditioning, etc. and also to introduce importance of new engineering materials.

UNIT I THERMAL APPLICATIONS 9

Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-conductivity of rubber tube and powder materials - heat transfer through fenestrations, thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices - central heating.

UNIT II VENTILATION AND REFRIGERATION 9

Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

UNIT III ACOUSTICS AND LIGHTING DESIGNS 9

Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multi-storeyed buildings. Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT IV NEW ENGINEERING MATERIALS 9

Composites - Definition and Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

UNIT V NATURAL DISASTERS 9

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

TOTAL: 45 PERIODS

OUTCOME:

- The students will have the knowledge on physics related to civil engineering and that knowledge will be used by them in various applications.

REFERENCES:

1. Mathur D.S., “Properties of Matter”, Chand and Co., New Delhi (2002).
2. William H. Severns and Julian R. Fellows, “Air conditioning and Refrigeration”, John Wiley and Sons, London (1988).
3. Stevens W.R., “Building Physics: Lighting”, Oxford New York: Pergaman Press (1969).

4. Leon Reiter, “Earthquake hazard analysis - Issues and insights”, Columbia University Press, (1991).
5. Hull B. and John, V., “Nondestructive Testing”, Mc.Millar Education Ltd., London (1988).
6. Eugine Hecht, “Optics”, Pearson Education Inc. (2002).
7. Alexander D., “Natural disaster”, UCL Press, London (1993).
8. Shearer P.M., “Introduction to Seismology”, Cambridge University Press (1999).
9. Kenneth G.Budinski and Michel K., Budinski, “Engineering Materials Properties and Selection”, Pearson, Singapore (2002).

PTCY7101 CHEMISTRY FOR CIVIL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To develop an understanding about the chemistry of building materials.
- Brief elucidation on corrosion and its control.
- To develop sound knowledge about the water science and technology.
- To impart basic knowledge on adhesives, abrasives, refractories and composites.
- To understand the basic concepts of chemical and instrumental methods of analysis.

UNIT I CHEMISTRY OF BUILDING MATERIALS 9

Introduction-lime: types-manufacture and properties-cement-Portland cement, setting and hardening of cement, types of cement, analysis of cement and dolomite, special cement. Concrete-manufacture and its properties-gypsum plaster. Ceramic-clay products-white ware, stone ware and earthen ware. Glass-manufacture, types, properties and it uses. Fly ash-properties and uses.

UNIT II CORROSION AND ITS CONTROL 9

Introduction-chemical and electrochemical corrosions-mechanism of electrochemical and galvanic corrosions-concentration cell corrosion-passivity-soil, pitting, inter-granular, water line, stress and microbiological corrosions-galvanic series-factors influencing corrosion-measurement of corrosion rate. Corrosion control-material selection and design-electrochemical protection- sacrificial anodic protection and impressed current cathodic protection. Protective coatings- metallic coatings (hot dipping, metal cladding, galvanizing, tinning, electroplating, electroless plating), non-metallic inorganic coatings, organic coatings (paints).

UNIT III ADHESIVES AND COMPOSITES 9

Adhesives: Introduction on adhesive action, definitions, development of adhesive bond strength- physical and chemical factors influencing adhesive action- classification of adhesives-important synthetic adhesives. Composites – Introduction – definition – constitution-classification-applications of composite materials-fiber reinforced composites-properties of reinforced composites.

UNIT IV ABRASIVES AND REFRACTORIES 9

Abrasives: Definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: Definition, characteristics, classification, properties-refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of Refractories- general method; acidic Refractories-fire clay, silica; basic refractories - magnetite, dolomite; neutral refractories-silicon carbide, zircon.

UNIT V WATER AND INSTRUMENTAL ANALYSIS 9

Properties of water, sources, quality for different uses-significance of water quality parameter pH, EC, TDS, hardness, chloride, sulphate, iron, fluoride, nitrate, BOD, COD, and heavy metals (As, Hg, Cr, Pb) and their determination by titrimetry, electrometry, UV-visible, AAS, ICP-AES, softening of water by ion exchange method, municipal water treatment, principle, coagulations, filtration, and disinfection. Desalination by reverse osmosis method.

TOTAL: 45 PERIODS

OUTCOME:

- Will be familiar with corrosion and its control.
- Will know the characterization techniques.
- Will know the water quality analysis for industrial applications.

TEXTBOOKS:

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2014.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2012.

REFERENCES:

1. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014
2. Gurdeep R. Chatwal, Sharma K. Anand, Instrumental methods of Chemical Analysis, Himalaya Publishers, New Delhi, 2014
3. Mary Jane Shultz "Engineering Chemistry". Cengage Learning India private Ltd., New Delhi., 2007.
4. Ashima Srivastava., Janhavi N. N., ''Concepts of Engineering Chemistry"., ACME Learning Private Limited., New Delhi., 2010.
5. Vairam S, Kalyani P, Suba Ramesh., "Engineering Chemistry". Wiley India Pvt. Ltd., New Delhi., 2011.

PTGE7151 COMPUTING TECHNIQUES L T P C

(Common to all branches of Engineering and Technology) 3 0 0 3

OBJECTIVE:

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures - Unions

TOTAL :45 PERIODS

OUTCOME:

At the end of the course, the student should be able to:

- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort**.**
  Use programming language to solve problems

TEXTBOOKS:

1. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Byron S Gottfried, “Programming with C”, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007

PTCE7101 STRENGTH OF MATERIALS I L T P C
3 0 0 3

OBJECTIVES:

- To learn fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin shells.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyse a computer two dimensional state of stress and plane trusses.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 10

Rigid and deformable bodies – Stability, strength and stiffness - Axial and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Biaxial state of stress – Elastic Constants - Stresses and deformation of thin cylindrical and spherical shells – Stresses at a point - Stresses on inclined planes – Principal stresses and principal planes – Mohr’s circle of stress.

UNIT II ANALYSIS OF PLANE TRUSSES 8

Stability and equilibrium of plane frames – Perfect frames - Types of trusses – Analysis of forces in truss members – Method of joints – Method of tension co-efficient – Method of sections.

UNIT III BENDING OF BEAMS 10

Beams – Types and transverse loading on beams – Shear force and bending moment in beams – Cantilever beams – Simply supported beams and over-hanging beams - Theory of simple bending – Bending stress distribution – Load carrying capacity – Proportioning of sections – Leaf springs – Flitched beams – Shear stress distribution.

UNIT IV TORSION 8

Theory of simple torsion - Stresses and deformation in circular and hollow shafts – Stepped shafts – Shafts fixed at both ends – Stresses and deflection in helical springs- introduction to torsion of rectangular sections-warping

UNIT V DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method for computation of slopes and deflections in determinate beams- deflection due to shear.

TOTAL: 45 PERIODS

OUTCOMES:

The students will have

- Thorough understanding of the fundamental concepts of stresses and strains in one dimensional and two dimensional states.
- The ability to analyse determinate beams and plane trusses.
- A sufficient knowledge in designing shafts to transmit required power and also springs for its maximum energy storage capacities.

TEXTBOOKS:

1. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi 2001
2. Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014.
3. Rajput.R.K. Strength of Materials, S.Chand & Company Ltd., New Delhi 2014.
4. Elangovan.A, Porul Valimaiyiyal I, Anna University, 2011
5. Timoshenko.S.P. and Young .D.H., Elements of Strength of Materials, V Edition, Affiliated East-West Press Pvt. Ltd., New Delhi, 2002.
6. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, 2010.

REFERENCES:

1. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
2. Beer. F.P. & Johnston.E.R."Mechanics of Materials", Tata McGraw Hill, New Delhi 2010.
3. James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.

PTMA7252 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
(Common to Civil, ECE) 3 0 0 3

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9

Fourier integral theorem – Fourier transform pair - Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange's linear equation – Solution of homogenous linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two dimensional heat equation.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9

Z- Transform – Elementary properties – Inverse Z- transform – Convolution theorem – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL : 45 PERIODS

OUT COMES :

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes.
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011
2. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
3. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
4. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTAG7201 ENGINEERING GEOLOGY L T P C
3 0 0 3

OBJECTIVES:

- At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies. The students of civil engineering will realize the importance of this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor. The knowledge of geophysical methods and remote sensing techniques are useful to know the various surface and subsurface features. Based on this, civil engineers can choose the types of foundations and other related aspects.

UNIT I PHYSICAL GEOLOGY 9

Geology in civil engineering – branches of geology – structure of earth and its composition – weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics

UNIT II MINEROLOGY 9

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT III PETROLOGY 9

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V GEOLOGICAL INVESTIGATION 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Coastal protection structures. Investigation of Landslides and earthquakes - causes and mitigation , seismic zonation – seismic zones of India.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing this course

- Will be able to understand the importance of geological knowledge such as earth,earthquake, volcanism and the action of various geological agencies.
- Will realize the importance of this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor
- Can choose the types of foundations and other related aspects.

TEXTBOOKS:

1. Varghese, P.C., Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi, 2012.
2. Venkatareddy. D. Engineering Geology, Vikas Publishing House Pvt. Ltd. 2010.
3. KVGK Gokhale, Principles of Engineering Geology, BS Publications, Hyderabad 2011.
4. N. Chenna Kesavulu. Textbook of Engineering Geology, Macmillan India Ltd., 2009.
5. Parbin Singh. A Text book of Engineering and General Geology, Katson publishing house, Ludhiana 2009.

REFERENCES:

1. Muthiayya, V.D.(1969), " A Text of Geology", Oxford IBH Publications, Calcutta.
2. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
3. F.G.Bell. Fundamentals of Engineering Geology, B.S. Publications. Hyderabad 2011.
4. Dobrin, M.B An introduction to geophysical prospecting, McGraw-Hill, New Delhi, 1988.

PTCE7201 FLUID MECHANICS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the students to the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes.

UNIT I FLUIDS PROPERTIES AND FLUID STATICS 9

Scope of fluid mechanics - Definitions of a fluid - Methods of analysis - Dimensions and units - viscosity, density, perfect gas, vapour pressure and surface tension - Basic equation of fluid statics - Pressure measurements - Manometers. - Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies - Relative equilibrium.

UNIT II BASIC CONCEPTS OF FLUID FLOW 9

(a) Kinematics – Methods of describing fluid motion - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets; (b) Dynamics - Dimensional Concepts of System and Control volume - Application of control volume to continuity, energy and momentum - Euler's equation of motion along a stream line - Bernoulli's equation - Applications to velocity and discharge measurements - Linear momentum equation and moment-of-momentum equations and their applications.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 9

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models.

UNIT IV INCOMPRESSIBLE VISCOUS FLOW 9

Laminar flow between parallel plates, and pipes - Development of laminar and turbulent flows in pipes - Reynolds experiment - Darcy-Weisbach equation - Moody diagram - Major and minor losses of flow in pipes - Pipes in series and in parallel.

UNIT V BOUNDARY LAYERS AND TRANSPORT BY ADVECTION AND DIFFUSION 9

Definition of boundary layers - Displacement, momentum and energy thickness - Laminar and turbulent boundary layers - Momentum integral equation – Steady molecular diffusion and conduction – Turbulent transport equations – Channel diffusion and Dispersions and Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.

TEXTBOOKS :

1. Streeter, V.L. Wylie, E. B. and Bedford K.W, *Fluid Mechanics.* (9^{th} ed) Tata McGraw Hill, New Delhi, 1998
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2003

REFERENCES :

1. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 1995.
2. Jain A. K. Fluid Mechanics. Khanna Publishers 1995.
3. Roberson J.A and Crowe C.T., Engineering Fluid Mechanics. Jaico Books Mumbai, 2000.

PTCE7202 PLANE AND GEODETIC SURVEYING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the rudiments of plane surveying and geodetic principles to Geoinformatics Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world problems.
- To introduce the concepts of Control Surveying
- To introduce the basics of Astronomical Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Classifications and basic principles of surveying – Chain survey – Basic principles and applications of Plane Table and Compass - Levels and staves - Methods of levelling - Booking - Reduction - Curvature and refraction - Contouring.

UNIT II THEODOLITE SURVEYING 9

Horizontal and vertical angle measurements - Temporary and permanent adjustments – Heights and distances–Tacheometric surveying – Trigonometric levelling – Horizontal curves in route surveying – classification, functions and requirements - methods of setting out simple curves.

UNIT III CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control- Methods - Triangulation- Base line - Instruments and accessories – Corrections - Satellite station - Traversing. Concepts of measurements and errors – error propagation and linearization – adjustment methods – least square methods – angles, lengths and levelling network – simple problems.

UNIT IV ASTRONOMICAL SURVEYING 9

Astronomical terms and definitions - Motion of sun and stars - Celestial coordinate systems – different time systems - Nautical Almanac - Apparent altitude and corrections - Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method

UNIT V MODERN SURVEYING 9

Total Station : Advantages - Fundamental quantities measured – Parts and accessories – working principle – On board calculations –Field procedure - Errors and Good practices in using Total Station

GPS: System components – Signal structure – Selective availability and antispoofing – receiver components – Planning and data acquisition – Data processing - Errors in GPS - Applications

Total : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to understand

- The use of various surveying instruments in mapping
- The error and adjustments procedures associated with surveying and mapping
- The methods used for establishment of horizontal and vertical control
- Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth

TEXTBOOKS :

1. T.P. Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. S.S.Bhavikatti, Surveying Theory and Practice, I.K.International Publishing House Pvt. Ltd, New Delhi, 2010

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. James M.Anderson and Edward M. Mikhail, Surveying Theory and Practice, Tata McGraw Hill Education Private Limited, New Delhi, 2012
3. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004
4. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice‘ Hall of India 2004
5. K.R. Arora, Surveying Vol I & II, Standard Book house , Twelfth Edition. 2013

PTCE7203 STRENGTH OF MATERIALS II L T P C
3 0 0 3

OBJECTIVES:

- To learn the computation of deflection of beams and trusses using energy principles and to know the concept of analysis of indeterminate beams.
- To estimate the load carrying capacity of columns and analysis of three dimensional state of stress.
- To understand the concept of theories of failure of materials, unsymmetrical bending, shear center and fracture of materials.

UNIT I ENERGY PRINCIPLES 9

Strain energy and strain energy density – Strain energy in axial force - Shear, flexure and torsion – Castigliano’s and Engessor’s theorems – Principle of virtual work – Application of energy theorems for computing deflections in beams – Maxwell’s reciprocal theorem.

UNIT II INDETERMINATE BEAMS 9

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading –– Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.

UNIT III COLUMNS 9

Behaviour of short and long columns. Euler's theory of long columns – Critical loads for prismatic columns with different end conditions - Rankine-Gordon Formula - Eccentrically loaded long columns -Eccentrically loaded short columns - middle third rule – Core of section.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9

Determination of principal stresses and principal planes – Volumetric strain – Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – Application in analysis of stress, load carrying capacity and design of members. Interaction problems - Interaction curves.

UNIT V ADVANCED TOPICS 9

Unsymmetrical bending of beams - symmetrical and unsymmetrical sections, shear centre – stresses on curved beams for simple solid sections – Winkler Bach Formula – Thick cylinders – Compound cylinders - residual stresses, stress concentration, fatigue.torsion of thin walled sections

TOTAL: 45 PERIODS

OUTCOMES:

- Students will have thorough knowledge in analysis of indeterminate beams and use of energy method for estimating the slope and deflections of beams and trusses.
- They will be in a position to assess the behaviour of columns, beams and failure of materials.

TEXTBOOKS:

1. Rajput.R.K. Strength of Materials, S.Chand & Company Ltd., New Delhi 2014.
2. Elangovan.A, Porul Valimaiyiyal-II, Anna University, 2011.
3. Punmia, B.C.,Theory of Structures (SMTS) Vol.I and II, Lakshmi Publishing Pvt. Ltd., New Delhi,2004.

REFERENCES:

1. Malhotra, D.R. Gupta, H.C., The Strength of Materials, Satya Prakashan, No. (Tech.India Publications), New Delhi 1995.
2. William A.Nash, Schaum's Outline Series, McGraw Hill International Editions, Fifth Edition, 2011.
3. Rattan S.S., Strength of Materials, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

PTGE7153 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth" s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia',Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi,2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

PTCE7301 HIGHWAY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To give an overview / basis of highway engineering with respect to the development, planning, design, construction and maintenance of highways.

UNIT I HIGHWAY PLANNING AND ALIGNMENT 8

History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 10

Typical cross sections of Urban and Rural roads –– Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses - IRC standards-Road signs and safety.

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Design principles – pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

UNIT IV HIGHWAY CONSTRUCTION AND MAINTENANCE 10

Highway construction materials, properties, testing methods – Construction practice including modern materials and methods of concrete and flexible pavements, Highway drainage – Special considerations for hilly roads; Evaluation and Maintenance of pavements.

UNIT V HIGHWAY ECONOMICS AND FINANCE 8

Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under Public-Private Sector Participation, Bidding process, Highway finance.

TOTAL: 45 PERIODS

OUTCOMES:

- The students completing this course would have acquired knowledge on planning, design, construction and maintenance of highways as per IRC standards and other methods.

TEXTBOOKS:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010
2. Veeraragavan. A, Khanna.K and Justo.C.E.G. Highway Engineering, Nem Chand & Bros Publishers, 2014
3. Subhash C Saxena, Textbook of Highway and Traffic Engineering., CBS Publishers, 2014

REFERENCES:

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005
2. Kadiyali. L. R. Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 1997.
1. Indian Road Congress (IRC), Guidelines and Special Publications on Planning and Design of Highways.
2. C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press ' (India) Private Limited, Hyderabad, 2015
3. R.Srinivasa Kumar., Textbook of Highway Engineering Universities Press (India) Private Limited, Hyderabad, 2011
4. Sharma.S.K Principles , Practices and Design of Highway Engineering, S.Chand and Company Ltd.1995
5. Clarkson.H Oglesby and R.Gary Hicks, Highway Engineering, John Wileysons, 1992.
6. O" Flaherty.C.A Highways, Butterworth– Heinemann, Oxford,2006

PTCE7302 SOIL MECHANICS L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic

Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and wier).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Line land and udl) Use of New marks influence chart –Components of settlement –— Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - √t and log t methods– e-log p relationship.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY 9

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop's method - Slope protection measures.

TOTAL: 45 PERIODS

OUTCOME:

- Students are able to classify the soil and assess the engineering properties, based on index properties. Students understand the basic concepts soil mechanics and able to design both finite and infinite slopes.

TEXTBOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006.
3. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2010.
3. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.

PTCE7303 STRUCTURAL ANALYSIS I L T P C
3 0 0 3

OBJECTIVES:

- To introduce the students to basic theory and concepts of classical methods of structural analysis and to find the deflection of determinate plane frames.

UNIT I DEFLECTION OF DETERMINATE FRAMES 9

Principles of virtual work for deflections - Deflections of pin-jointed plane frames and rigid plane frames –Williott's diagram.

UNIT II SLOPE DEFLECTION METHOD 9

Slope deflection equations- Analysis of continuous beams and rigid frames - Support settlements.

UNIT III MOMENT DISTRIBUTION METHOD 9

Stiffness and carry over factors – Distribution and carry over of moments - Analysis of continuous Beams - Plane rigid frames with and without sway – Support settlement.

UNIT IV MATRIX FLEXIBLITY METHOD 9

Equilibrium and compatibility - Determinate vs. indeterminate structures - Static and Kinematic Indeterminacy - primary structure - Compatibility conditions - Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames

UNIT V MATRIX STIFFNESS METHOD 9

Element and global stiffness matrices– Co-ordinate transformations – Rotation matrix - Compatibility matrix – transformations of stiffness matrices, load vectors and displacement vectors – Analysis of Continuous Beams – Analysis of pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will have the knowledge of analysing a structure using the classical methods and are able to draw the shear force and bending moment diagrams.

TEXTBOOKS:

1. Bhavikatti, S.S, Structural Analysis, Vol.1, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2010.
2. Bhavikatti, S.S, Structural Analysis, Vol.2, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2013.
3. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
4. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall, 2012.

REFERENCES:

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Delhi, 1995
2. Vaidyanathan,R & Perumal P, Structural Analysis, Vol.1 & 2, Laxmi Publications, New Delhi,2004
3. Pandit G.S. and Gupta S.P., Structural Analysis – A Matrix Approach, Tata McGraw Hill Publishing Company Ltd., 2006
4. Reddy .C.S, “Basic Structural Analysis”, Tata McGraw Hill Publishing Company, 2005.
5. Negi L.S. and Jangid R.S., Structural Analysis, Tata McGraw Hill Publishing Co. Ltd. 2004.

PTCE7311 PLANE AND GEODETIC SURVEYING LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To familiarize with the various surveying instruments and methods.

EXCERCISES :

1. Determination of area of polygon by base line method using chain
2. Chain traversing
3. Fly levelling
4. Check levelling
5. Study of theodolite and its accessories

6. Measurement of horizontal and vertical angles using theodolite
7. Determination of tacheometric constants
8. Determination of elevation of an object using single plane method when base is accessible/ inaccessible
9. Determination of distance and difference in elevation between two inaccessible points using double plane method.
10. Heights and distances by stadia tacheometry
11. Heights and distances by tangential tacheometry
12. Study of Total station and GPS(demonstration only)

TOTAL : 60 PERIODS

OUTCOMES:

- At the end of the course the student will be able to use various surveying instruments like chain, level and theodolite for mapping.

REFERENCES:

1. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. James M.Anderson and Edward M. Mikhail, Surveying Theory and Practice, Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004
5. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice‘ Hall of India 2004
6. K.R. Arora, Surveying Vol I & II, Standard Book house , Tenth Edition, 2008

PTCE7401 APPLIED HYDRAULIC ENGINEERING L T P C
2 2 0 3

OBJECTIVES:

- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

UNIT I UNIFORM FLOW 12

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS 12

Dynamic equations of gradually varied and spatially varied flows - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method - Applications.

UNIT III RAPIDLY VARIED FLOWS 12

Application of the energy equation for RVF - Critical depth and velocity - Critical, Sub-critical and Super-critical flow - Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation - Surges.

UNIT IV TURBINES 12

Turbines - Classification - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Runaway speed - Similarity laws.

UNIT V PUMPS 12

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.

TOTAL: 60 PERIODS

OUTCOMES:

- The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
- They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
- They will have knowledge in hydraulic machineries (pumps and turbines).

TEXTBOOKS:

1. Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi, 2010.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
3. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2000.

REFERENCES:

1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Rajesh Srivastava, Flow through open channels, Oxford University Press, New Delhi, 2008.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2005.

PTCE7402 DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To introduce the various philosophies of R.C. design and to study in detail the limit state design of structural elements such as beams, columns and footings

UNIT I DESIGN CONCEPTS AND WORKING STRESS DESIGN OF BEAMS 10

Various design concepts - Concept of elastic method, ultimate load method and limit state method – Advantages of Limit State method over other methods – Limit State philosophy as detailed in current IS Code. Design of rectangular beam section by working stress method.

UNIT II LIMIT STATE DESIGN OF BEAMS 10

Design of singly and doubly reinforced rectangular and flanged beams – use of design aids for flexure – Behaviour of R.C. beams in shear and torsion – Shear and torsional reinforcement – Limit State design of R.C. members for combined bending, shear and torsion – Use of design aids. Design requirement for bond and anchorage as per IS code. Serviceability requirements, importance of cracked and uncracked section.

UNIT III LIMIT STATE DESIGN OF SLABS 10

Behaviour of one way and two way slabs - design of one way simply supported, cantilever and continuous slabs. Design of two-way slabs for various edge conditions.-Introduction to flat slab - Types of staircases - design of dog-legged staircase.

UNIT IV LIMIT STATE DESIGN OF COLUMNS AND FOOTING 10

Types of columns – design of short columns for axial load, combined axial load with uniaxial and biaxial bending - use of design aids. Design of footing for masonry and reinforced walls – design of axially and eccentrically loaded square and rectangular footings – design of combined rectangular footings for two columns only- Introduction to strap footing, raft/mat foundation.

UNIT V MASONRY MEMBERS 5

Determination of permissible stresses on masonry, load carrying capacity of masonry walls and pillars - Design of masonry walls, pillars and footings as per IS Codes.

TOTAL: 45 PERIODS

OUTCOMES:

- The student shall be in a position to design the basic elements of reinforced concrete structures.

TEXTBOOKS:

1. Sinha.S.N., Reinforced Concrete Design, Second Edition, Tata McGraw Hill Publishing Company, 2002.
2. Varghese.P.C., Limit State Design of Reinforced Concrete, Second Edition Prentice Hall Inc., 2010,
3. Gambhir. M.L., Fundamentals of Reinforced Concrete Design, Prentice Hall Inc., 2006.
4. Anand.S.Arya, Masonry and Timber Structures including Earthquake Resistant Design, Nem Chand and Bros., 2006.

REFERENCES:

1. IS 456–2000, Indian Standard – Plain and Reinforced Concrete – Code of Practice, Fourth Edition.
2. IS 1905–1987, Indian Code of Practice for Structural use of Unreinforced Masonry.
3. National Building Code of India 2005 (NBC 2005), Bureau of Indian Standards.
4. Dayaratnam.P., Limit State Design of Reinforced Concrete Structures, Oxford, IBH Publishing Company Pvt. Ltd., 2008.
5. Unnikrishna Pillai and Devdass Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., 2005

PTCE7403 RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the students about Railways planning, design, construction and maintenance and planning design principles of airport and harbour

UNIT I RAILWAY PLANNING AND CONSTRUCTION 10

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods--Geometric design of railway, gradient, super elevation, widening of guage on curves- Level Crossings. .

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 8

Earthwork – Stabilization of track on poor soil - Tunneling Methods, drainage and ventilation – Calculation of Materials required for track laying - Construction and maintenance of tracks – Railway Station and yards and passenger amenities

UNIT III AIRPORT PLANNING 7

Air transport characteristics-airport classification-air port planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, typical Airport Layouts, Case Studies, parking and Circulation Area

UNIT IV AIRPORT DESIGN 10

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.

UNIT V HARBOUR ENGINEERING 10

Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011

TOTAL: 45 PERIODS

OUTCOMES:

- On completing the course, the students will have the ability to Plan and Design various civil Engineering aspects of Railways, Airports and Harbour.

TEXTBOOKS:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010
2. Saxena Subhash, C.and Satyapal Arora, ACourse in Railway Engineering, DhanapatRai and Sons, Delhi, 1998
3. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 1994

REFERENCES:

1. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels., Universities Press (India) Private Limited, Hyderabad, 2015.
2. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013

PTCE7404 STRUCTURAL ANALYSIS II L T P C
3 0 0 3

OBJECTIVE:

- To learn the method of drawing influence lines and its uses in various applications like beams, bridges and plane trusses.
- To analyse the arches, suspension bridges and space trusses.
- Also to learn Plastic analysis of beams and rigid frames.

UNIT I MOVING LOADS AND INFLUENCE LINES 9

Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads - influence lines for member forces in pin jointed frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE STRUCTURES 9

Muller Breslau's principle – Application of Muller Breslau's principle to determinate beams and continuous beams.

UNIT III ARCHES 9

Arches - Structural forms – Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches – Settlement and temperature effects- introduction to folded plates.

UNIT IV SUSPENSION BRIDGES AND SPACE TRUSSES 9

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders - Introduction to analysis of space trusses using method of tension coefficients – Beams curved in plan.

UNIT V PLASTIC ANALYSIS 9

Statically indeterminate structures – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism - Static and kinematic methods – Upper and lower bound theorems -Plastic analysis of indeterminate beams and frames.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will have the knowledge of influence line and its uses in analysis of beams, stiffening girder in bridges and plane trusses.

TEXTBOOKS:

1. Bhavikatti,S.S, Structural Anal ysis, Vol.1, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2010.
2. Bhavikatti,S.S, Structural Analysis, Vol.2, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2013.
3. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi Publications, 2004.
4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publisers,2015.
5. Vaidyanathan.R and Perumal.P, Structural Analysis, Vol.2, Laxmi Publications, 2015.

REFERENCES:

1. Negi.L.S and Jangid R.S ., Structural Analysis , Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd. 2002.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
4. Prakash Rao D.S., Structural Analysis, Universities Press, 1996.

PTCE7405 WATER SUPPLY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To equip the students with the principles and design of water treatment and distribution.

UNIT I SOURCES OF WATER 9

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II CONVEYANCE FROM THE SOURCE 9

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation –Clarifloccuator-Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management –Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 9

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems – RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances.

UNIT V WATER DISTRIBUTION AND SUPPLY 9

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Economics – Analysis of distribution networks -Computer applications – Appurtenances – Leak detection.

Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
- an understanding of water quality criteria and standards, and their relation to public health
- the ability to design and evaluate water supply project alternatives on basis of chosen selection criteria

TEXTBOOKS:

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
3. Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2010.

REFERENCES:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

PTCE7501 DESIGN OF STEEL AND TIMBER STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To learn the limit state design of steel components subjected to tension, compression and bending and timber structures.

UNIT I SECTIONS AND JOINTS 12

Types of steel structures – Properties of rolled steel sections and Light gauge steel sections – Riveted and bolted connections – Failures of joints – Single and multiple bolted lap and butt joints under axial and eccentric loading – Strength of fillet and butt welded joints – Design of riveted, bolted and welded joints- HSFG bolts

UNIT II TENSION MEMBERS 8

Design of simple and built-up members subjected to tension –Effective area of angles connected to gussets – shear lag-lug angles.

UNIT III COMPRESSION MEMBERS 8

Maximum slenderness ratio of various compression members – IS code provision for compression members – Design of simple and built-up compression members with lacings and battens – Design of column bases.

UNIT IV BEAMS 11

Design of simple beams based on strength and stiffness as per IS code – Design of built–up beams and curtailment of flange plates –Flange splice and web splice- Design of plate girder and stiffeners- design of brackets

UNIT V TIMBER 6

Study of properties and strength of natural and laminated timber – Allowable stresses in compression, tension and flexure as per IS Code – Types of joints with nails and bolts – Design of simple compression members as per IS code– Design of beams for strength and stiffness as per IS code.

TOTAL: 45 PERIODS

OUTCOME:

- The students will have knowledge on the design of structural steel members subjected to compressive, tensile and bending forces, as per current code and also know to design Timber Members.

TEXTBOOKS:

1. Subramanian.N, Design of Steel Structures, Oxford University Press, 2008.
2. Punmia, Ashok Kumar Jain, B.C.Punmia, Comprehensive design of Steel Structures, Laxmi Publications, 2005.
3. Duggal.S.K, Limit State Design of Steel Structures, Tata McGraw Hill Publishing Company, 2010.
4. S. Ramamrutham and R. Narayanan, Design of Steel Structures -, Dhanpat Rai Publishing Company, 2003

REFERENCES:

1. Narayanan.R.et.al. Teaching Resource on Structural Steel Design, INSDAG, Ministry of Steel Publications, 2002.
2. Shah.V.L. and Veena Gore, Limit State Design of Steel Structures IS 800–2007 Structures Publications, 2009.
3. Bhavikatti.S.S, Design of Steel Structures By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009.
4. IS 800-2007 Indian Standard for General Construction in Steel — Code of Practice.
5. IS 883-1994 Indian Standard for Design of Structural Timber in Building - Code of Practice.

PTCE7502 **FOUNDATION ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVE:

- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction potential - Selection of foundation based on soil condition- Bore log report.

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) - Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFTS 9

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision

UNIT IV PILE FOUNDATION 9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Uplift capacity-Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Codal provision.

UNIT V RETAINING WALLS 9

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision.

TOTAL: 45 PERIODS

OUTCOME:

- Students are able to plan, execute a detailed site investigation programme, selection of appropriate geotechnical design parameters and type of foundations. Students are capable of carrying out geotechnical design for different types of foundations and retaining walls.

TEXTBOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2015.
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P) Ltd, New Delhi,2006.
3. Arora, K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.
4. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.

5. Sahashi K Gulhati, Manoj Datta, “Geotechnical Engineering”, Tata McGraw-Hill Education, 2005.

REFERENCES:

1. Das, B.M. “Principles of Foundation Engineering” (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
2. Kaniraj, S.R. “Design aids in Soil Mechanics and Foundation Engineering”, Tata McGraw Hill publishing company Ltd., New Delhi, 2002.
3. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt.Ltd., New Delhi, 2005.
4. Venkatramaiah, C., “Geotechnical Engineering”, New Age International Publishers, New Delhi, 2007 (Reprint)
5. IS Code 6403 : 1981 (Reaffirmed 1997) “Bearing capacity of shallow foundation”, Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) “Shallow foundations subjected to symmetrical static vertical loads”, Bureau of Indian Standards, New Delhi.
7. IS Code 8009 (Part 2):1980 (Reaffirmed 1995) “Deep foundations subjected to symmetrical static vertical loading”, Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 1) : 1979 (Reaffirmed 1997) “Concrete Piles” Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 2) : 1979 (Reaffirmed 1997) “Timber Piles”, Bureau of Indian Standards, New Delhi.
10. IS Code 2911 (Part 3) : 1979 (Reaffirmed 1997) “Under Reamed Piles”, Bureau of Indian Standards, New Delhi.
11. IS Code 2911 (Part 4) : 1979 (Reaffirmed 1997) “Load Test on Piles”, Bureau of Indian Standards, New Delhi.
12. IS Code 1904: 1986 (Reaffirmed 1995) “Design and Construction of Foundations in Soils”, Bureau of Indian Standards, New Delhi.
13. IS Code 2131: 1981 (Reaffirmed 1997) “Method for Standard Penetration test for Soils”, Bureau of Indian Standards, New Delhi.
14. IS Code 2132: 1986 (Reaffirmed 1997) “Code of Practice for thin – walled tube sampling for soils”, Bureau of Indian Standards, New Delhi.
15. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.
16. IS Code 14458 (Part 1) : 1998 “Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall” , Bureau of Indian Standards, New Delhi.
17. IS Code 14458 (Part 2) : 1998 “Retaining Wall for Hill Area – Guidelines, Design of Retaining/Breast Walls” , Bureau of Indian Standards, New Delhi.
18. IS Code 14458 (Part 3) : 1998 “Retaining Wall for Hill Area – Guidelines, Construction Of Dry Stone Walls” , Bureau of Indian Standards, New Delhi.

PTCE7503 IRRIGATION ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the students to the concept of soil-plant characteristics and their water requirements.
- To understand the necessity of planning an irrigation system to provide water at the right time and right place.

UNIT I IRRIGATION PRINCIPLES 9

Need for irrigation – Advantages and ill effects – Development of irrigation – National Water Policy – Tamil Nadu scenario - Physical properties of soil that influence soil moisture characteristics – Concept of soil water potential and its components: Gravitational and Osmotic pressures- Retention of water in soils - Concept of available water – Movement of water into and within the soils – Measurement of soil moisture content.

UNIT II CROP WATER REQUIREMENT 8

Necessity and importance– Crop and crop seasons in India –Duty, Delta, Base Period– Factors affecting Duty-Irrigation efficiencies– Consumptive use of water-Irrigation requirements of crops - Standards for irrigation water- Planning and Development of irrigation projects.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Head works –Weirs and Barrages –Types of impounding structures - Factors affecting, location of dams -Forces on a dam -Design of Gravity dams; Earth dams, Arch dams – Spillways -Energy dissipaters.

UNIT IV CANAL IRRIGATION 11

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlets, Escapes –Lining and maintenance of canals – Other methods of Irrigation: Surface, Subsurface – Merits and Demerits.

UNIT V IRRIGATION WATER MANAGEMENT 8

Modernization techniques – Rehabilitation – Command Area Development - Systems of rice intensification - Water delivery systems - Participatory Irrigation Management – Farmers' organization and turn over – Water users' associations - Economic aspects of irrigation.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have knowledge and skills on Planning, design, operation and management of reservoir system.
- The student will gain knowledge on different methods of irrigation including canal irrigation.

TEXTBOOKS:

1. Sharma, R.K., and Sharma, T.K., "Irrigation Engineering", S. Chand and Company, New Delhi, 2008.
2. Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.
3. Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.

REFERENCES:

1. Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard Publishers Distributors, New Delhi, 2009.
2. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
3. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
4. Punmia, B.C., "Irrigation and Water Power Engineering", Laxmi Publishers, New Delhi, 2008.

PTCE7504 WASTEWATER ENGINEERING L T P C

3 0 0 3

OBJECTIVE:

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

Characteristics and composition of sewage-- population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage-Storm runoff estimation – sewer appurtenances – corrosion in sewers – prevention and control – sewage pumping-drainage in buildings-plumbing systems for drainage.

UNIT II PRIMARY TREATMENT OF SEWAGE 9

Objectives – Unit Operations and Processes – Selection of treatment processes –- Onsite sanitation - Septic tank- Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks – Construction, Operation and Maintenance aspects.

UNIT III SECONDARY TREATMENT OF SEWAGE 10

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters - other treatment methods – Sequencing Batch Reactor – Membrane Bioreactor - UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

UNIT IV DISPOSAL OF SEWAGE 9

Standards for– Disposal - Methods – dilution – Self purification of surface water bodies Oxygen sag curve – deoxygenation and reaeration - Land disposal – Sewage farming – sodium hazards - Soil dispersion system.

UNIT V SLUDGE TREATMENT AND DISPOSAL 8

Objectives - Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – ultimate residue disposal – recent advances.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- ability to estimate sewage generation and design sewer system including sewage pumping stations
- required understanding on the characteristics and composition of sewage, self-purification of streams
- ability to perform basic design of the unit operations and processes that are used in sewage treatment

TEXTBOOKS:

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers,New Delhi, 2015.
2. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.
3. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.

REFERENCES:

1. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
3. Syed R. Qasim “Wastewater Treatment Plants”, CRC Press, Washington D.C.,2010
4. Gray N.F, “Water Technology”, Elsevier India Pvt. Ltd., New Delhi, 2006.

PTCE7601 ESTIMATION, COSTING AND VALUATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

UNIT I QUANTITY ESTIMATION 9

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, roads, canals and hydraulic structures using computer softwares.

UNIT II RATE ANALYSIS AND COSTING 9

Standard Data – Observed Data – Schedule of rates – Market rates – Assessment of Man Hours and Machineries for common civil works – Rate Analysis – Cost Estimates using Computer softwares.

UNIT III SPECIFICATIONS AND TENDERS 9

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering-Digital signature certificates- Encrypting -Decrypting – Reverse auctions.

UNIT IV CONTRACTS 9

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements.

UNIT V VALUATION 9

Definitions – Various types of valuations – Valuation methods – Valuation of land – Buildings – Valuation of plant and machineries.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will be able to estimate the quantity and cost for a typical structure and will be prepare the tender and contract document. The student will be able to perform valuation for building and land.

TEXTBOOKS:

1. B.N Dutta ‘Estimating and Costing in Civil Engineering’, UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, ‘Civil Engineering Contracts and Estimates’, University Press, 2006
3. D.N. Banerjee, ‘Principles and Practices of Valuation’, V Edition, Eastern Law House, 1998

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003

PTCE7602 GROUND IMPROVEMENT TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:

- Students will be exposed to various problems associated with soil deposits and methods to evaluate them. The different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

UNIT I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 8

Role of ground improvement in foundation engineering – Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

UNIT II DEWATERING 10

Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

UNIT III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 10

Insitu densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations.

UNIT IV EARTH REINFORCEMENT 9

Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

UNIT V GROUTING TECHNIQUES 8

Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring – Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

TOTAL: 45 PERIODS

OUTCOME:

- Based on the knowledge gained student will be in a position to identify and evaluate the deficiencies if any in the deposits of the given project area and capable of providing alternative methods to improve its quality so that the structures built on it will be stable and serve the intended purpose.

TEXTBOOKS:

1. Purushothama Raj. P, “Ground Improvement Techniques”, Firewall Media, 2005.
2. Koerner, R.M. “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, 1994.

REFERENCES:

1. Moseley, M.P., “Ground Improvement Blockie Academic and Professional”, Chapman and Hall, Glasgow, 2004.
2. Moseley, M.P and Kirsch. K., ‘Ground Improvement mediation”, Sponress, Taylor and Francis Group, London, 2004.
3. Jones C.J.F.P. “Earth Reinforcement and Soil Structure”, Thomas Telford Publising, 1996.
4. Winterkorn, H.F. and Fang, H.Y. “Foundation Engineering Hand Book”. Van Nostrand Reinhold, 1994.
5. Das, B.M., “Principles of Foundation Engineering” (seventh edition), Cengage learning, 2010.

6. Coduto, D.P., “Geotechnical Engineering – Principles and Practices”, Prentice Hall of India Pvt.Ltd. New Delhi, 2011.
7. Koerner, R.M., “Designing with Geosynthetics” (Fourth Edition), Prentice Hall, Jersey, 2012.
8. IS Code 9759 : 1981 (Reaffirmed 1998) “Guidelines for Dewatering During Construction”, Bureau of Indian Standards, New Delhi.
9. IS Code 15284 (Part 1): 2003 “Design and Construction for Ground Improvement – Guidelines” (Stone Column), Bureau of Indian Standards, New Delhi.

PTCE7603 STRUCTURAL DESIGN AND DRAWING L T P C
2 0 2 3

OBJECTIVES:

- This course aims at providing students with a solid background on the principles of structural engineering design. Students will be acquire the knowledge of liquid retaining structures, bridges components, retaining wall and industrial structures.

UNIT I INTRODUCTION AND PLANNING 6

Introduction - Planning and Design Process – Types of Loading – Dead , Live, Wind and Earthquake loads - Fabrication Drawing of Simple Riveted, Bolted and Welded Connections.

UNIT II LIQUID STORAGE STRUCTURES 6

RC Water Tanks- On ground – Circular, underground- Rectangular – Hemispherical Bottomed Steel Water Tank –-Design and Drawing

UNIT III DESIGN OF BRIDGE COMPONENTS 6

IRC Specifications and Loading – Solid Slab RC Bridge – Steel Foot-over Bridge- Design and Drawing.

UNIT IV RETAINING WALLS 6

RC Cantilever and Counterfort Retaining Walls – Horizontal Backfill with Surcharge – Design of Shear Key- Design and Drawing.

UNIT V INDUSTRIAL STRUCTURES 6

Steel Roof Trusses – Roofing Elements – Purlins – crane/gantry girders- Self supported Chimney - Design and Drawing.

TOTAL (L:30+P:30) : 60 PERIODS

OUTCOMES:

- At the end of the course the student acquires hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

TEXTBOOKS:

1. Krishnaraju N, Structural Design and Drawing, Universities Press, 2009.
2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.

REFERENCES:

1. Krishnamurthy D, Structural Design and Drawing Vol I, II and III, CBS Publishers, 2010.
2. Shah V L and Veena Gore, Limit State Design of Steel Structures IS 800-2007, Structures Publications, 2009.
3. IS 456(2000) Indian Standard Plain and Reinforced Concrete -Code of Practice, Bureau of Indian Standards, New Delhi.

4. SP34 Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
5. IS 800 (2007) Indian Standard General Construction In Steel — Code of Practice, Bureau of Indian Standards, New Delhi.
6. IS 875 Part 1 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice - Dead Load, Bureau of Indian Standards, New Delhi.
7. IS 875 Part 2 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice - Imposed Load, Bureau of Indian Standards, New Delhi.
8. IS 875 Part 3 (2003) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Code of Practice - Wind Load, Bureau of Indian Standards, New Delhi.
9. IS 3370 Part 1 (2009) Indian Standard Concrete Structures for Storage of Liquids - Code of Practice – General Requirements, Code of Practice, Bureau of Indian Standards, New Delhi.
10. IS 3370 Part 2 (2009) Indian Standard Concrete Structures for Storage of Liquids - Code of Practice - Reinforced Concrete Structures, Code of Practice, Bureau of Indian Standards, New Delhi.
11. IS 3370 –Part 4 (2008) Indian Standard Code of Practice for Concrete Structures for The Storage of Liquids - Design Tables, Code of Practice, Bureau of Indian Standards, New Delhi.
12. IS 804 (2008) Indian Standard Specification for Rectangular Pressed Steel Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
13. IS 805 (2006) Indian Standard Code of Practice for Use of Steel in Gravity Water Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
14. IRC 112-2011, Code of Practice for Concrete Road Bridges, The Indian Roads Congress, New Delhi.
15. IRC 6 -2014, Standard Specifications and Code of Practice for Road Bridges Section: II - Loads and Stresses, The Indian Roads Congress, New Delhi.

PTMG7751 PRINCIPLES OF MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:

- To study the Evolution of Management
- To study the functions and principles of management
- To learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager vs. Entrepreneur- Types of Managers- Managerial Roles and Skills – Evolution of Management –Scientific, Human Relations, System and Contingency Approaches– Types of Business Organization- Sole Proprietorship, Partnership, Company- Public and Private Sector Enterprises- Organization Culture and Environment – Current Trends and Issues in Management.

UNIT II PLANNING 9

Nature and Purpose of Planning – Planning Process – Types of Planning – Objectives – Setting Objectives – Policies – Planning Premises – Strategic Management – Planning Tools and Techniques – Decision Making Steps and Process

UNIT III ORGANISING 9

Nature and Purpose – Formal and Informal Organization – Organization Chart– Organization Structure – Types – Line and Staff Authority – Departmentalization – Delegation of Authority –

Centralization and Decentralization –Job Design – Human Resource Management –HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career Planning and Management.

UNIT IV DIRECTING 9

Foundations of Individual and Group Behavior– Motivation – Motivation Theories – Motivational Techniques – Job Satisfaction – Job Enrichment – Leadership – Types and Theories of Leadership – Communication – Process of Communication – Barrier in Communication – Effective Communication – Communication and IT.

UNIT V CONTROLLING 9

System and Process of Controlling – Budgetary and Non-Budgetary Control Techniques –Use of Computers and IT in Management Control – Productivity Problems and Management – Control and Performance – Direct and Preventive Control – Reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would have gained the ability to learn the different principles and techniques of management in planning, organizing, directing and controlling.

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall of India, Tenth Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, Sixth Edition, 2004.

REFERENCES:

1. Stephen A. Robbins, David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, Seventh Edition, 2011.
2. Robert Kreitner and Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Harold Koontz and Heinz Weihrich “Essentials of Management” Tata McGraw Hill, 1998.
4. Tripathy PC and Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999.

PTCE7701 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To understand the behaviour of dynamic loading. Study the effect of earthquake loading on the behaviour of structures. Understand the codal provisions to design the structures as earthquake resistant.

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF) system – Formulation of equation of motion for various SDOF system – D’ Alemberts Principles – Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic forces.

UNIT II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multidegree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

UNIT III INTRODUCTION TO EARTHQUAKE ENGINEERING 9

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters.

UNIT IV EARTHQUAKE EFFECTS ON STRUCTURES 9

Effect of earthquake on different types of structures – Behaviour of RCC, Steel and prestressed Concrete Structures under earthquake loading – Pinching Effect – Bouchinger Effects – Evaluation of Earthquake forces – IS Code 1893: 2002 – Response Spectra – Lessons learnt from past earthquakes.

UNIT V CONCEPTS OF EARTHQUAKE RESISTANT DESIGN 9

Causes of damage – Planning considerations/Architectural concept (IS 4326–1993) – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry buildings – Design consideration – Guidelines – Earthquake resistant design of R.C.C. buildings – Lateral load analysis – Design and detailing (IS 13920:1993).

TOTAL: 45 PERIODS

OUTCOMES:

- The student will have the knowledge to analyse structures subjected to dynamic loading and to design the structures for seismic loading as per code provisions.

TEXTBOOKS:

1. Mario Paz, Structural Dynamics – Theory and Computations, Fourth Edition, CBS publishers, 1997.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.

REFERENCES:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
2. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, Elements of Earthquake Engineering, South Asia Publishers, 1994.
3. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986
4. Humar.J.L, Dynamics of Structures, Prentice Hall Inc., 1990.
5. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
6. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.

PTCE7711 PROJECT WORK L T P C
0 0 9 6

OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 135 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

PTGE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES L T P C
3 0 0 3

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.
-

UNIT I HUMAN VALUES 3

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY 12

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and Chernobyl as case studies.

UNIT V GLOBAL ISSUES 12

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXTBOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thomson Learning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thomson Learning, United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000
5. R. Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

PTGE7073 **HUMAN RIGHTS** **L T P C**
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., “Human Rights under International law and Indian Laws”, Central Law Agency, Allahabad, 2014.
2. Chandra U., “Human Rights”, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi

PTGE7074 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning--Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma Process Capability–Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.

PTGE7075 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXTBOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C
3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PTAI7001 HYDROLOGY AND WATER RESOURCES ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources**.**

UNIT I PRECIPITATION AND ABSTRACTIONS 10

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation-Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception- Evaporation. Horton’s equation, pan evaporation measurements and evaporation suppression- Infiltration-Horton’s equation-double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Runoff estimation using empirical - Strange’s table and SCS methods – Stage discharge relationships-flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts-Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS 8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TOTAL: 45 PERIODS

OUTCOMES:

- The students gain the knowledge needed on hydrologic cycle, hydrometeorology and formation of precipitation.
- The students are able to apply the various methods of field measurements and empirical formulae for estimating the various losses of precipitation, stream flow, flood and flood routing.
- The students will know the basics of groundwater and hydraulics of subsurface flows

TEXTBOOKS:

1. Subramanya .K. Engineering Hydrology- Tata McGraw Hill, 2013.
2. Jayarami Reddy .P. Hydrology, Tata McGraw Hill, 2008.

REFERENCES:

1. David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. Applied Hydrology, McGraw Hill International Book Company, 2010.
3. Raghunath .H.M., Hydrology, Wiley Eastern Ltd., 2004

PTAI7002 INTEGRATED WATER RESOURCES MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To introduce the students to the interdisciplinary analysis of water and design of intervention strategies.
- To develop knowledge base on capacity building on IWRM.

UNIT I IWRM FRAMEWORK 9

Definition – meanings –objectives- evolution of IWRM- IWRM relevance in water resources management – Importance of paradigm shift in India: processes and prospective outcomes.

UNIT II CONTEXTUALIZING IWRM 9

IWRM in Global and Regional water partnership - MDG goals - UN formulations-Institutional Transformation- bureaucratic reforms and inclusive development.

UNIT III EMERGING ISSUES IN WATER MANAGEMENT 9

IWRM and Irrigation – Domestic - Drinking water Management in the context of Climate change-Flood –Drought – Pollution – Water poverty-sanitation and health-Conceptual problems and policy issues.

UNIT IV IWRM AND WATER RESOURCES DEVELOPMENT IN INDIA 9

Rural Development-Ecological sustainability- Watershed Development and conservation-Ecosystem Regeneration – waste water reuse-Sustainable livelihood and food security-Links between water –health- and poverty.

UNIT V ASPECTS OF INTEGRAL DEVELOPMENT 9

Capacity building - Solutions for effective Water Management. Case studies on conceptual framework of IWRM – IWRM and regional and global partnership – Emerging issues – IWRM and water resources development

TOTAL: 45 PERIODS

OUTCOME:

- At the completion of the course, the student will be able to apply appropriate management techniques different components of water resources under IWRM framework.

TEXTBOOKS:

1. Mollinga .P. etal " Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006
2. Sithamparanathan, Rangasamy, A., and Arunachalam, N., "Ecosystem Principles and Sustainable Agriculture", Scir Publisher, Chennai, 1999.

REFERENCES:

1. Cech Thomas V., Principles of Water Resources: History, Development, Management and Policy. John Wiley and Sons Inc., New York. 2003.
2. Murthy, J.V.S., "Watershed Management in India", Wiley Eastern Ltd., New York, 1995.
3. Dalte, S.J.C., "Soil Conservation and Land Management", International Book Distribution, India, 1986.

PTAI7003 PARTICIPATORY WATER RESOURCES MANAGEMENT L T P C
3 0 0 3

OBJECTIVE :

- To gain an insight on local and global perceptions and approaches on participatory water resource management

UNIT I FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH 6

Sociology – Basic concepts – Perspectives- Social Stratification – Irrigation as a Socio technical Process - Participatory concepts– Objectives of participatory approach - WUA

UNIT II UNDERSTANDING FARMERS PARTICIPATION 10

Farmers participation –need and benefits – Comparisons of cost and benefit -Sustained system performance - Kinds of participation – Context of participation, factors in the environment – WUA - Constraints in organizing FA – Role of Community Organiser – Case Studies.

UNIT III ISSUES IN WATER MANAGEMENT 9

Multiple use of water – Issues in Inter-sectoral Water Allocation - domestic, irrigation, industrial sectors - modernization techniques – Rehabilitation – Command Area Development - Water delivery systems – Participatory Governance.

UNIT IV PARTICIPATORY WATER CONSERVATION 10

Global Challenges -Social – Economic – Environmental - Solutions –Political - Water Marketing – Water Rights -Consumer education – Success Stories Case Studies

UNIT V PARTICIPATORY WATERSHED DEVELOPMENT 10

Concept and significance of watershed - Basic factors influencing watershed development –- Principles of watershed management - Definition of watershed management – Identification of problems - Watershed approach in Government programmes –- People's participation – Entry point activities - Evaluation of watershed management measures.

TOTAL: 45 PERIODS

OUTCOMES:

- The students shall gain knowledge on the various processes involved in participatory water resource management.
- The students shall be aware of the issues related to water conservation.

TEXTBOOKS:

1. Sivasubramaniyan, K. Water Management, SIMRES Publication, Chennai, 2011.
2. Uphoff.N., Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management, No.11, Westview press, Boulder,CO, 1986.
3. Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996.

REFERENCE:

1. Chambers Robert, Managing canal irrigation, Cambridge University Press, 1989

PTCE7001 AIR POLLUTION AND CONTROL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

UNIT I INTRODUCTION 7

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards –Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT II METEOROLOGY 6

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 11

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 11

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

UNIT V INDOOR AIR QUALITY MANAGEMENT 10

Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- ability to identify, formulate and solve air and noise pollution problems
- ability to design stacks and particulate air pollution control devices to meet applicable
- standards.

TEXTBOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.
3. Anjaneyulu. Y, “Air Pollution and Control Technologies" , Allied Publishers (P) Ltd., India 2002.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak „Air Pollution" , Lweis Publishers, 2000.
2. Arthur C.Stern, „Air Pollution (Vol.I – Vol.VIII)" , Academic Press, 2006.
3. Wayne T.Davis, „Air Pollution Engineering Manual" , John Wiley & Sons, Inc.,2000.

PTCE7002 **CARTOGRAPHY** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce Cartography as science and technology of Map making.
- The course also introduces its connections with Communication Science, Computer technology and IT.
- To outline the Cartography as a creative art.

UNIT I MAP – A SPECIAL GRAPHIC COMMUNICATOR 6

Maps, their functions and use – Definition of Cartography – Types of Maps – other cartographic products – map making steps – surveying and mapping – Role of IT and computers, RS, GIS and GPS– Map Scales and Contents –accuracy and errors- History of Cartography – Mapping organizations in India.

UNIT II ABSTRATION OF EARTH AND MAP PROJECTION 12

Concepts of sphere, ellipsoid and geoid - latitudes, longitudes and graticules –map projections – shape, distance, area and direction properties - role of aspect, development surface, secant and light source / view points – perspective and mathematical projections – Indian maps and projections – Map co-ordinate systems – UTM and UPS references – common projections and selections– projections for hemispheres and the world maps.

UNIT III MAP COMPILATION AND DESIGN 9

Base map concepts – scanning and digitization – planimetric, topographic and thematic information – sample and census surveys – attribute data tables – Elements of a map - Map Layout principles – Map Design fundamentals – symbols and conventional signs - graded and ungraded symbols - color theory - colours and patterns in symbolization – map lettering

UNIT IV MAP MAKING 9

Definition of chropleth , daysimetric and isopleth maps – class interval selection and shading – isopleth maps and interpolation strategies – located symbol maps – flow maps – cadestral and engineering maps – demographic and statistical mapping –sequential maps – map production – map printing– colours and visualization – map reproduction – printing soft copies and standards.

UNIT V MAP TRANSFORMATIONS 9

Map generalization – attribute conversions and transforms – reduction and enlargement - fusions - geometric transformations – bilinear and affine transformations - hardware and software in map making – conversion to multimedia, internet and web objects - mobile maps– cartometry.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student shall

- Be familiar with appropriate map projection and co-ordinate system for production of maps.
- Be able compile and design maps for the required purpose.
- Be familiar with co-ordinate and datum transformations.

TEXTBOOKS:

1. R. W. Anson and F. J. Ormeling, Basic Cartography for students and Technicians. Vol. I, II and III, Elsevier Applied Science Publishers, 3rd Edition, 2004.
2. Arthur, H. Robinson , Joel L. Morrison , Phillip C. Muehrcke, A. Jon Kimerling, Stephen C. Guptill Elements of Cartography, Sixth Edition, John Wiley and Sons, 2009.
3. Gretchen N.Peterson, GIS Cartography : A Guide to effective Map design, second edition, CRC press Taylor & Trancis group, 2014.

REFERENCES:

1. John Campbell, introductory Cartography, Wm. C. Brown Publishers, Third Edition, 2004.
2. Menno Jan Kraak & Ferjan Ormeling, Cartography Visualization of Geospatial Data, Second Edition, Pearson Education, 2004
3. Geographic Visualization, Martin Dodge, Marrs Mc derby & Martin Turner. John wiley & srena, west sin sex, England, 2008
4. Thematic Cartography and Geovisualisation 3rd edition by Terry A slocum, Robert B Mc Master, fritz C Kessler, Hugh H Howard, Prentice Hall, 2013.

PTCE7003 COASTAL ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To provide an overview of the analysis and design procedures used in the field of coastal engineering
- To enable students to determine the characteristics of waves, coastal structures and shore protection and modeling in coastal engineering

UNIT I INTRODUCTION TO COASTAL ENGINEERING 9

Introduction - Wind and waves – Sea and Swell - Introduction to small amplitude wave theory – use of wave tables- Mechanics of water waves – Linear (Airy) wave theory – Wave measurement. .

UNIT II WAVE PROPERTIES AND ANALYSIS 9

Introduction to non-linear waves and their properties – Waves in shallow waters – Wave Refraction, Diffraction and Shoaling – Hindcasting of waves - Short term wave analysis – wave spectra and its utilities - Long term wave analysis- Statistical analysis of grouped wave data.

UNIT III TYPES AND WAVE TRANSFORMATION 9

Tide analysis and prediction, storm surge, seiches and seasonal fluctuations - Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction

UNIT IV COASTAL STRUCTURES AND SHORE PROTECTION 9

Risk analysis – design wave – Break waters – Shore protection – groins, seal walls, offshore breakwaters, artificial nourishment

UNIT V MODELING IN COASTAL ENGINEERING 9

Physical modeling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – limitations

TOTAL: 45 PERIODS

OUTCOME:

On successfully completing this course unit, students will be able to:

- Calculate the wave transformations
- Appreciate the multi-faceted nature of coastal problems and the techniques of coastal engineering analysis, modeling and design of coastal structures and shore protection.

TEXTBOOKS:

1. Kamphuis, J.W., Introduction to coastal engineering and management, 2000
2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994.
3. Mani, J. S. Coastal Hydrodynamics. PHI Learning Pvt. Ltd., 2012.

REFERENCES:

1. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, Inc., New York, 1978.
2. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, NewYork, 1978.
3. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006.

PTCE7004 COMPUTER AIDED DESIGN OF STRUCTURES L T P C
3 0 0 3

OBJECTIVES:

- To understand the design and analysis of structures using softwares and to optimize the structural components.

UNIT I INTRODUCTION 9

Fundamental reason for implementing CAD - Software requirements – Hardware components in CAD system – Design process - Applications and benefits.

UNIT II COMPUTER GRAPHICS 9

Graphic Software – Graphic primitives - Transformations - 2 Dimensional and 3 Dimensional transformations – Concatenation - Wire frame modeling - Solid modeling - Graphic standards - Drafting packages – Auto CAD.

UNIT III STRUCTURAL ANALYSIS 9

Principles of structural analysis - Fundamentals of finite element analysis - Concepts of finite elements – Stiffness matrix formulation – Variational Method – Weighted residual method – Problems – Conditions of convergence of functions – Analysis packages and applications.

UNIT IV DESIGN AND OPTIMIZATION 9

Principles of design of steel and RC structures - Beams and Columns - Applications to simple design problems - Optimization techniques - Algorithms - Linear programming.

UNIT V EXPERT SYSTEMS 9

Introduction to artificial intelligence - Knowledge based expert systems – Applications of KBES- Rules and decision tables - Inference mechanisms - simple applications

TOTAL: 45 PERIODS

OUTCOMES:

- Students acquire the knowledge in computer aided design of structures.

TEXTBOOKS:

1. Groover M.P. and Zimmers E.W.Jr., CAD / CAM, Computer Aided Design and Manufacturing, Prentice Hall of India Ltd, New Delhi, 2008.
2. Krishnamoorthy.C.S., Rajeev,S, Rajaraman, A and Computer Aided Design: Software and Analytical Tools, Narosa Publishing House, New Delhi,2012.

REFERENCE:

1. Harrison H.B., Structural Analysis and Design, Part I and II Pergamon Press, Oxford, 1990.

PTCE7005 **CONCRETE TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete and special concretes.

UNIT I CONSTITUENT MATERIALS 9

Cement-Different types-Chemical composition and Properties-Tests on cement-IS Specifications-Aggregates-Classification-Mechanical properties and tests as per BIS grading requirements-Water- Quality of water for use in concrete

UNIT II CHEMICAL AND MINERAL ADMIXTURES 9

Accelerators-Retarders- Plasticizers- Super plasticizers- Water proofers- Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline-Their effects on concrete properties

UNIT III PROPORTIONING OF CONCRETE MIX 9

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design- Design Mix and Nominal Mix-BIS and ACI Methods of Mix Design-Mix Design Examples

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS-Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete-Determination of Young's Modulus

UNIT V SPECIAL CONCRETES 9

Light weight and Heavy weight concretes-High strength concrete- Fibre reinforced concrete- Ferro cement -Ready mix concrete-SIFCON- Shotcrete -Polymer concrete-High performance concrete-Their production, properties and applications

TOTAL : 45 PERIODS

OUTCOMES:

- The student will possess the knowledge on properties of materials required for concrete tests on those materials and design procedures for making conventional and special concretes.

TEXTBOOKS:

1. Santhakumar,A.R; Concrete Technology , Oxford University Press,New Delhi, 2007
2. Shetty,M.S; Concrete Technology, S.Chand and Company Ltd, New Delhi 2003

REFERENCES:

1. Neville, A.M; Properties of Concrete, Pitman Publishing Limited, London,1981
2. Gambir, M.L; Concrete Technology, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007,Third Edition
3. IS: 10262-1982 Recommended Guidelines for Concrete Mix Design,Bureau of Indian Standards, New Delhi

PTCE7006 DESIGN OF PLATE AND SHELL STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To learn the design of plate and shell and spatial structures

UNIT I THIN PLATES WITH SMALL DEFLECTION 10

Laterally loaded thin plates - Governing differential equation, various boundary conditions.

UNIT II RECTANGULAR PLATES 10

Simply supported rectangular plates - Navier solution and Levy's method – Loading.

UNIT III ANALYSIS OF THIN SHELLS 5

Shells of revolution – Spherical dome, Conical shell and ellipsoid of revolution – Shells of translation – Cylindrical shell and Hyperbolic parabolid - Classification of shells - Types of shells - Structural action.

UNIT IV DESIGN OF SHELLS 10

Spherical dome, Conical shell and Cylindrical shell.

UNIT V SPACE FRAMES 10

Space Frames – Configuration – Node connector- Types – General principles of design philosophy – Behaviour.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have indepth knowledge in the analysis and design of plates, shells and space frame structures

TEXTBOOKS:

1. P.C.Varghese, Design of Reinforced Concrete Shells and Folded Plates, PHI Learning Private Limited, New Delhi, 2010.
2. R.Szilard, Theory and Analysis of Plates, Prentice Hall Inc., 1995.
3. N.Subramanian, Principles of Space Structures, Wheeler Publishing Co. 1999.

REFERENCES:

1. Billington D.P. Thin Shell Concrete Structures, McGraw Hill,1995.
2. Chatterjee B.K. Theory and design of Concrete Shells, Oxford and IBH Publishing Co., New Delhi 1998.

PTCE7007 DESIGN OF PRESTRESSED CONCRETE STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To understand the behaviour and performance of prestressed concrete structures. Compare the behaviour of prestressed concrete members with that of the normal reinforced concrete structures. Understand the performance of composite members. Finally to learn the design of prestressed concrete structures.

UNIT I INTRODUCTION 9

Historical developments – Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per I.S.1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength limit based on I.S. 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9

Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9

Analysis and design of composite beams - Shrinkage strain and its importance – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V MISCELANEOUS STRUCTURES 9

Design of tension and compression members – Design of sleepers, Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 PERIODS

OUTCOMES:

- Student will have knowledge on methods of prestressing and able to design various prestressed concrete structural elements.

TEXTBOOKS:

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, fifth edition, 2012.
2. Pandit.G.S. and Gupta.S.P., Prestressed Concrete, CBS Publishers and Distributers Pvt. Ltd., Second edition , 2014.

REFERENCES:

1. Lin T.Y. and Ned.H.Burns, Design of prestressed Concrete Structures, John Wiley and Sons, 1982.
2. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2002.
3. Arthur H.Nilson, Design of Prestressed Concrete, John Wiley and Sons, 1987.
4. Dayaratnam.P., Prestressed Concrete Structures, Fourth Edition, Oxford and IBH, 1987.
5. Sinha.N.C. and Roy.S.K., Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011.

PTCE7008 DIGITAL CADASTRE L T P C
3 0 0 3

OBJECTIVES:

- To introduce the students to the cadastral survey Methods and its applications in generation of Land information system. Cadastral surveys are those classes of land surveys which are executed for the purpose of systematically recording the land rights, producing register of land holdings or an inventory of land areas, land use and determine land tax.

UNIT I INTRODUCTION 9

History of cadastral survey - Types of survey - Tax - Real Property – Legal cadastre -Graphical and Numerical Cadastre, Legal Characteristics of Records, Torrens System.

UNIT II METHODS OF SURVEYING 9

Cadastral Survey Methods - Steps in survey of a village - Instruments used for cadastral survey & mapping - Orthogonal, Polar survey methods - Boundary survey - Rectangulation - Calculation of area of Land- GPS and Total Station in Cadastral survey.

UNIT III MAINTENANCE AND MEASUREMENTS 9

Cadastral survey maintenance - Resurveys - Measurement of sub-division - Measurement of obstructed lines - Survey of urban areas - Control requirement for Urban survey use of Satellite Imagery in boundary fixing.

UNIT IV PHOTOGRAMMETRIC METHODS 9

Photogrammetry for cadastral surveying and mapping - Orthophoto map – Quality control measures - Organisation of cadastral offices – international scenario.

UNIT V MAPPING PROCEDURES AND LIS 9

Cadastral map reproduction - Map projection for cadastral maps – Conventional symbols - map - reproduction processes - Automated cadastral map, Management of Digital Cadastral. Creation of Land Information System. Integrating LIS –Land administration.

TOTAL: 45 PERIODS

OUTCOMES:

- The courses give the knowledge about Land Record System and computational procedure for modernization of the same.
- The students will be in position to understand the Government procedure in Land Record Management.

TEXTBOOKS:

1. Paul. R Wolf., Bon A. DeWitt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014
2. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

REFERENCES:

1. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.
3. James, M. Anderson and Edward N. Mikhail, Introduction to Surveying, McGraw Hill Book Co, 1985.

PTCE7009 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

UNIT I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework–Stakeholders and their Role in EIA– Selection & Registration Criteria for EIA Consultants – Screening and Scoping in EIA – Drafting of Terms of Reference

UNIT II ENVIRONMENTAL ASSESSMENT 9

Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis of alternatives

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Environmental Clearance – Post Project Audit

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis- Public Consultation

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads and Bridges – Mass Rapid Transport Systems - Ports and Harbor – Airports - Dams and Irrigation projects - Power plants – Wastewater Treatment Plants- Waste Processing and Disposal facilities – Mining Projects.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have ability to

- carry out scoping and screening of developmental projects for environmental and social assessments
- explain different methodologies for environmental impact prediction and assessment
- plan environmental impact assessments and environmental management plans
- evaluate environmental impact assessment reports

TEXTBOOKS:

1. Canter, R.L (1995). Environmental impact Assessment, 2nd Edition, McGraw Hill Inc., New Delhi.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu. (1997). Environmental Impact Assessment for Developing Countries in Asia. Volume 1 – Overview, Asian Development Bank
3. Peter Morris, Riki Therivel (2009)," Methods of Environmental Impact Assessment", Routledge Publishers

REFERENCES:

1. Becker H. A., Frank Vanclay (2003), The International handbook of social impact assessment: conceptual and methodological advances, Edward Elgar Publishing
2. Barry Sadler and Mary McCabe (2002), "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme.
3. Judith Petts, Handbook of Environmental Impact Assessment Vol. I and II, Blackwell Science, New York, 1998.
4. Ministry of Environment and Forests (2010), EIA Notification and Sectoral Guides, Government of India, New Delhi.

PTCE7010 GEO-ENVIRONMENTAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.

UNIT I GENERATION OF WASTES AND CONSQUENCES OF SOIL POLLUTION 8

Introduction to Geo environmental engineering – Environmental cycle – Sources, production and classification of waste – Causes of soil pollution – Factors governing soil pollution interaction clay minerals - Failures of foundation due to waste movement.

UNIT II SITE SELECTION AND SAFE DISPOSAL OF WASTE 10

Safe disposal of waste – Site selection for landfills – Characterization of land fill sites and waste – Risk assessment – Stability of landfills – Current practice of waste disposal – Monitoring facilities – Passive containment system – Application of geosynthetics in solid waste management – Rigid or flexible liners.

UNIT III TRANSPORT OF CONTAMINANTS 8

Contaminant transport in sub surface – Advection, Diffusion, Dispersion – Governing equations – Contaminant transformation – Sorption – Biodegradation – Ion exchange – Precipitation – Hydrological consideration in land fill design – Ground water pollution.

UNIT IV WASTE STABILIZATION 10

Stabilization - Solidification of wastes – Micro and macro encapsulation – Absorption, Adsorption, Precipitation – Detoxification – Mechanism of stabilization – Organic and inorganic stabilization – Utilization of solid waste for soil improvement.

UNIT V REMEDIATION OF CONTAMINATED SOILS 9

Exsitu and insitu remediation-Solidification, bio-remediation, incineration, soil washing, electro kinetics, soil heating, vetrification, bio-venting.

TOTAL: 45 PERIODS

OUTCOME:

- Students are able to assess the contamination in the soil and to select suitable remediation methods based on contamination. Also they are able to prepare the suitable disposal system for particular waste.

TEXTBOOKS:

1. Hari D. Sharma and Krishna R. Reddy, “Geo-Environmental Engineering” –John Wiley and Sons, INC, USA, 2004.
2. Daniel B.E., “Geotechnical Practice for waste disposal”, Chapman & Hall, London 1993.
3. Manoj Datta,” Waste Disposal in Engineered landfills”, Narosa Publishing House, 1997.
4. Manoj Datta, B.P. Parida, B.K. Guha, “Industrial Solid Waste Management and Landfilling Practice”, Narosa Publishing House, 1999.

REFERENCES:

1. Westlake, K, “Landfill Waste pollution and Control”, Albion Publishing Ltd., England, 1995.
2. Wentz, C.A., “Hazardous Waste Management”, McGraw Hill, Singapore, 1989
3. Proceedings of the International symposium on “Environmental Geotechnology” (Vol.I and II). Environmental Publishing Company, 1986 and 1989.
4. Ott, W.R., “Environmental indices, Theory and Practice”, Ann Arbor, 1978.
5. Fried, J.J., “Ground Water Pollution”, Elsevier, 1975.
6. ASTM Special Tech. Publication 874, Hydraulic Barrier in Soil and Rock, 1985.
7. Lagrega, M.D., Buckinham, P.L. and Evans, J.C., “Hazardous Waste Management” McGraw Hill Inc. Singapore, 1994.

PTCE7011 GEOGRAPHIC INFORMATION SYSTEM L T P C
3 0 0 3

OBJECTIVES :

- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data structures and input, management and output processes.

UNIT I FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS 9

Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

UNIT III DATA INPUT AND TOPOLOGY 9

Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input –Digitiser – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration

UNIT IV DATA QUALITY AND STANDARDS 9

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure

UNIT V DATA MANAGEMENT AND OUTPUT 9

Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS-distributed GIS.

TOTAL: 45 PERIODS

OUTCOME:

- This course equips the student to have basic knowledge about the GIS its structure, quality and standards.

TEXT BOOKS:

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007.

REFERENCE:

1. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006

PTCE7012 GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERS L T P C
3 0 0 3

OBJECTIVE:

- To solve the Civil Engineering problems with the help of Geoinformatics technique.

UNIT I LAND RESOURCE MANAGEMENT 6

Total Station and GPS Surveys – Topographic and Bathymetric Surveys – Cadastral Information – Soil and Land Use Surveys - Land Information System (LIS) – Real Estate Information System

UNIT II STRUCTURAL STUDIES 6

Deformation studies of deflection - Dam deformation - structural movement - Pavement yield - shifting sand-bank and shoreline – Landslide Risk Analysis

UNIT III SOIL CONSERVATION AND MANAGEMENT 9

Soil survey interpretation and mapping - impact of agricultural and industrial activity on soil properties - soil erosion - factors influencing soil erosion - soil contamination using Hyper spectral Remote Sensing - mining pollution- EMR responses with contaminated soil - modeling soil characteristics using satellite data - soil degradation assessment using Remote Sensing and GIS - Land reclamation studies

UNIT IV URBAN AND TRANSPORTATION MANAGEMENT 12

Monitoring Urban Growth through Remote Sensing - Geo-demographic Analysis – Property Market Analysis Urban Renewal - traffic analysis - accident analysis - site suitability analysis for transport infrastructure –transportation databases: creation and maintenance - Vehicle routing – Highway maintenance system – Intelligent Transportation System

UNIT V WATER RESOURCES PLANNING AND MANAGEMENT 12

Location of storage/diversion works – capacity curve generation – sediment yield - modelling of catchments – Delineation of watershed - Watershed modelling for sustainable development - Rainfall – Runoff modelling –LiDAR Mapping for Urban area –Water quality mapping and monitoring – Flood Risk Zoning - Flood damage assessment – Flood Modelling - Assessment of droughts and mitigation

TOTAL: 45 PERIODS

OUTCOME:

- The student shall be capable of solving Civil Engineering problems with Geoinformatics technology.

TEXTBOOKS:

1. Basudeb Bhatta, 'Remote Sensing and GIS', Second edition, Oxford University Press 2011.
2. C.P.Lo.Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, Second edition, PHI Learning Private Limited, Delhi, 2014.

REFERENCES:

1. Andrew N. Rencz, Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring, John Wiley & Sons Inc, April 2004
2. Rashed, Tarek; Jürgens, Carsten (Eds.), Remote Sensing of Urban and Suburban Areas, Springer, 1st Edition. 2010.
3. Harvey J. Miller, Shih-Lung Shaw, Geographic Information Systems for Transportation – Principles and Applications, Oxford University Press, 2001.
4. Gert A. Schulitz Edwin T. Engman, Remote Sensing in hydrology and Water Management, Springer - verlag Berlin Heidelberg Germany - 2000.

PTCE7013 GROUNDWATER ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the student to the principles of Groundwater governing equations and characteristics of different aquifers
- To understand the techniques of development and management of groundwater.

UNIT I HYDROGEOLOGICAL PARAMETERS 9

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms.

UNIT II WELL HYDRAULICS 9

Objectives of Groundwater hydraulics – Darcy's Law - Groundwater equation – Flow net Theory – steady state flow - Dupuit Forchheimer assumption - Unsteady state flow - Theis method - Jacob method -Slug tests - Image well theory – Partial penetrations of wells.

UNIT III GROUNDWATER MANAGEMENT 9

Need for Management Model – Database for groundwater management – BIG DATA, Data Mining–groundwater balance study – Introduction to Mathematical model – Flow and Transport– Conjunctive use – Collector well and Infiltration gallery.

UNIT IV GROUNDWATER QUALITY 9

Ground water chemistry – Origin- Point Source, Non Point Source, movement and quality - Water quality standards – Health and aesthetic aspects of water quality - Saline intrusion – Environmental concern and Regulatory requirements

UNIT V GROUNDWATER CONSERVATION 9

Artificial recharge techniques – Remediation of Saline intrusion– Ground water management studies – Protection zone delineation, Contamination source inventory, remediation schemes: Physical, Chemical, Biological- Ground water Pollution and legislation.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to understand aquifer properties and its dynamics after the completion of the course. It gives an exposure towards well design and practical problems of groundwater aquifers.
- Students will be able to understand the importance of artificial recharge and groundwater quality concepts.

TEXTBOOKS:

1. Raghunath H.M., Ground Water Hydrology, New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., Ground Water Hydrology, John Wiley and Sons, New York, 2000.

REFERENCES:

1. Fitts R Charles. Groundwater Science. Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

PTCE7014 INDUSTRIAL STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To learn the layout, functional aspects and design of steel and R.C structures used in industries.

UNIT I PLANNING 9

Classification of industries and industrial structures – General requirements of various industries – Planning and layout of buildings and components.

UNIT II FUNCTIONAL REQUIREMENTS 9

Lighting – Ventilation - Acoustics – Fire safety – Guidelines from factories act.

UNIT III DESIGN OF STEEL STRUCTURES 9

Industrial roofs – Crane girders – pre-engineered and Mills buildings – Bunkers and Silos – pipe/cable racks- Chimney.

UNIT IV DESIGN OF R.C. STRUCTURES 9

Corbels, Brackets and Nibs - Silos and bunkers –Chimney - Principles of folded plates and shell roofs

UNIT V PREFABRICATION 9

Principles of prefabrication – Prestressed precast roof trusses - Construction of roof and floor slabs - Wall panels- storage/transportation/handling in yard/site and erection –joints in precast structures.

TOTAL: 45 PERIODS

OUTCOMES:

- At the end of this course the student shall be able to design some of the structures used in industries.

TEXTBOOKS:

1. Ramamrutham.S., Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, 2007.
2. Varghese.P.C., Advanced Reinforced Concrete Design, PHI, Eastern Economy Editions, Second Edition, 2005.
3. Bhavikatti.S.S., Design of Steel Structures, J.K. International Publishing House Pvt. Ltd., 2009.
4. Ramachandra and Virendra Gehlot , Design of steel structures -2, Scientific Publishers 2012.

REFERENCES:

1. Henn W. Buildings for Industry, Vol.I and II, London Hill Books, 1995
2. Handbook on Functional Requirements of Industrial buildings, SP32–1986, Bureau of Indian Standards, 1990.
3. Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982.
4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH, 1971.

PTCE7015 INDUSTRIAL WASTEWATER ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To provide knowledge on sources and characteristics of Industrial Wastewaters, Techniques and approaches for minimizing the generation of wastewaters at the source and application of physico-chemical, biological and advanced treatment methods for recovery, reuse and disposal of wastewaters in Indian Industries.

UNIT I INTRODUCTION 8

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters.

UNIT II INDUSTRIAL POLLUTION PREVENTION 5

Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay back period.

UNIT III TREATMENT OF INDUSTRIAL WASTEWATERS 13

Physico–Chemical Treatment Processes – Equalisation, Neutralisation, Oil Seperation, Flotation – Precipitation, Aerobic and Anaerobic Biological Treatment Processes – Sequencing batch reactors, membrane bioreactors, Advanced oxidation and Tertiary Treatment processes for removal of dissolved organics and inorganics- Ozonation, photocatalysis, Evaporation and membrane Technologies.

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9

Individual and Common Effluent Treatment Plants –Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse – Industrial reuse, Disposal on water and land – Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills.

UNIT V CASE STUDIES 10

Industrial manufacturing process description, Wastewater characteristics , Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries- Textiles- Pulp and Paper – Metal finishing – Sugar and Distilleries.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an insight into the pollution from major industries including the sources and characteristics of pollutants
- ability to plan minimization of industrial wastes
- ability to design facilities for the processing and reclamation of industrial waste water

TEXTBOOKS:

1. S.C.Bhatia, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003.
2. Mahajan, S.P.Pollution Control in Process Industries, Tata McGraw Hill Publishing Co., New Delhi, 1991.

REFERENCES:

1. Eckenfelder, W.W., „Industrial Water Pollution Control" , McGraw Hill, 2000.
2. Nelson Leonard Nemerow, "Industrial waste treatment – contemporary practice and vision for the future", Elsevier, Singapore, 2007.
3. Frank Woodard, „ Industrial waste treatment Handbook" , Butterworth Heinemann, NewDelhi,2001.
4. World Bank Group, „ Pollution Prevention and Abatement Handbook – Towards Cleaner Production" , World Bank and UNEP, Washington D.C., 1998
5. Paul L. Bishop, „ Pollution Prevention:- Fundamentals and Practice" , McGraw Hill International, Boston,2000.
6. Wang L.K., Yung-Tse Hung, Howard H.Lo and Constantine Yapijakis, „Handbook of Industrial and Hazardous Wastes Treatment" , Marcel Dekker, Inc., USA, 2004.

PTCE7016 INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS L T P C
3 0 0 3

OBJECTIVE:

- To understand the basics of dynamics – dynamic behaviour of soils – effects of dynamic loads and the various design methods.

UNIT I THEORY OF VIBRATION 9

Introduction – Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring – mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads

UNIT II WAVE PROPAGATION 9

Elastic waves in rods of infinite length – Longitudinal and Torsional – Effect of end conditions – Longitudinal and torsional vibrations of rods of finite length – Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space – Typical values of compres wave and shear wave velocity – Wave propagation due to Machine foundation – Surface wave – Typical values – Particle movements and velocity.

UNIT III DYNAMIC PROPERTIES OF SOILS 9

Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure.

UNIT IV FOUNDATION FOR DIFFERENT TYPES OF MACHI 9

Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions.

UNIT V INFLUENCE OF VIBRATION AND REMEDIATION 9

Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT-Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations.

TOTAL: 45 PERIODS

OUTCOME:

- Students are able to design foundation for different machines, assess the influence of vibrations and selection of remediation methods based on the nature of vibration, properties and behaviour of soil.

TEXT BOOKS:

1. Swamisaran, “Soil Dynamics and Machine Foundations”, Galgotia Publications Pvt.Ltd. (Second Edition) 2006, (Reprint 2010), New Delhi-110002
2. Kameswara Rao., “Dynamics Soil Tests and Applications”, Wheeler Publishing, New Delhi, 2003.
3. P. Srinivasulu, and C.V. Vaidyanathan, “Handbook of Machine Foundations”, Tata McGraw-Hill, 2007

REFERENCES:

1. Kamaswara Rao., “Vibration Analysis and Foundation Dynamics”, Wheeler Publishing, New Delhi, 1998.
2. IS Code of Practice for Design and Construction of Machine Foundations, McGrew Hill, 1996.
3. Moore, P.J., “Analysis and Design of Foundation for Vibration”, Oxford and IBH, 2005
4. Steven L. Kramer, “Geotechnical Earthquake Engineering”, Prentice Hall, 1996.

5. IS Code 5249: 1992 (Reaffirmed 2006) “Determination of Dynamic Properties of Soil - Method of Test” Bureau of Indian Standards, New Delhi.
6. IS Code 2974: (Part 1) 1982 (Reaffirmed 2008) “Code of Practice for Design and Construction of Machine Foundations - Foundation for Reciprocating Type Machines” Bureau of Indian Standards, New Delhi.
7. IS Code 2974: (Part 2) 1980 (Reaffirmed 2008) “Code of Practice for Design and Construction of Machine Foundations - Foundations for Impact Type Machines (Hammer Foundations)” Bureau of Indian Standards, New Delhi.
8. IS Code 2974: (Part 3) 1992 (Reaffirmed 2006) “Code of Practice for Design and Construction of Machine Foundations - Foundations for Rotary Type Machines (Medium and High Frequency)” Bureau of Indian Standards, New Delhi.

PTCE7017 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion - - Effects of cover thickness.

UNIT III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake. demolition techniques - Engineered demolition methods - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Students have the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

TEXT BOOKS:

1. Shetty.M.S. Concrete Technology - Theory and Practice, S.Chand and Company, 2008.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
4. R. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann,Elsevier,New Delhi 2012

REFERENCES:

1. Dov Kominetzky.M.S., - Design and Construction Failures, Galgotia Publications Pvt.Ltd., 2001
2. Ravishankar.K., Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.
3. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
4. Hand Book on "Repair and Rehabilitation of RCC Buildings" – Director General works CPWD ,Govt of India , New Delhi – 2002

PTCE7018 MUNICIPAL SOLID WASTE MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND CHARACTERISTICS 8

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO" s- Public Private participation.

UNIT II ON-SITE STORAGE AND PROCESSING 8

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

UNIT III COLLECTION AND TRANSFER 8

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV OFF-SITE PROCESSING 12

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V DISPOSAL 9

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management
- ability to plan waste minimisation and design systems for storage, collection, transport, processing and disposal of municipal solid waste

TEXTBOOKS:

1. George Tchobanoglous and FrankKreith(2002).Handbook of Solid waste Management, McGraw Hill, New York.
2. William A. Worrell, P. Aarne Vesilind, Solid Waste Engineering, Cengage Learning, 2012.

REFERENCES:

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2014.
2 Bhide A.D. and Sundaresan, B.B. Solid Waste Management Collection, Processing and Disposal, 2001, ISBN 81-7525-282-0

PTCE7019 PAVEMENT ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.

UNIT I TYPE OF PAVEMENT AND STRESS DISTRIBUTIONON LAYERED SYSTEM 8

Introduction – Pavement as layered structure – Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading.

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 10

Flexible pavement design Factors influencing design of flexible pavement, Empirical - Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

UNIT III DESIGN OF RIGID PAVEMENTS 9

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 10

Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

UNIT V STABILIZATION OF PAVEMENTS 8

Stabilisation with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilisation for rural roads in India – Use of Geosynthetics in roads.

TOTAL: 45 PERIODS

OUTCOME:

- Students are able to design different new pavements and rehabilitate the existing roads using recent technology.

TEXTBOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers, Revised 10th Edition, 2014.
2. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna tech.Publications, New Delhi, 2005.

REFERENCES:

1. Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements,IRC-37–2001,The Indian roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

PTCE7020 POWER PLANT STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To study the layout, functional aspects and principles involved in the selection of different types of Power Plant Structures.

UNIT I FUNDAMENTALS OF POWER PLANTS 9

Introduction – Classification of Power Plants – Principles of Power Plant – Lay out of Power Plant Building – Selection of type of generation – Resources for power generation – Machine foundation.

UNIT II HYDRO ELECTRIC POWER PLANTS 9

Elements of hydro-electric power plants – Advantages and disadvantages of water power – General and essential elements of Hydro electric Power Plant – Structural requirements – Selection of site for hydro electric plant – Penstocks and surge Tanks in Power Station.

UNIT III THERMAL POWER PLANTS 9

Planning, Analysis of thermal power plants – Layout – Ash handling – Dust collection – Induced draught and natural cooling towers – Air/water pollution by thermal power plants.

UNIT IV NUCLEAR POWER PLANTS 9

General characteristics of Nuclear Power Plants – Classification of reactors – Pressurized Water Reactor, Boiling Water Reactor, Fusion Power Reactor, Heavy Water Reactor - Selection criteria of materials for different systems – Containment structures – Nuclear power plant safety measures – Safety systems and support systems.

UNIT V NON CONVENTIONAL POWER PLANTS 9

Types – Wind power plants – Selection of wind mill – Tidal power plants – Solar thermal power plants – Geothermal power plants – Principles and essential features.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will be able to understand the operations of different types of power plants. The students will be able to analyse and design various power plant components like surge tanks, cooling towers and containment structures.

TEXTBOOKS :

1. S.C. Sharma and G.R. Nagpal, Power Plant Engineering, Khanna Publishers,2013
2. Raja A.K, Amit Prakash Srivastava and Manish Dwivedi, Power Plant Engineering, New Age International Publishers, 2006.

REFERENCES :

1. Lewis.E.E., Nuclear Power Reactor Safety, Willey Inter Science, 1977.
2. Srinivasasulu.P and Vaidyanathan.C.V., Hand book on Machine Foundations, Tata McGraw Hill Publishing Co. Ltd., 2007.
3. Gilbert Gedeon.P.E., Planning and Design of Hydro Electric Power Plants, CECW-ED Engineer Manual, 1110-2-3001 Manual No.1110-2-3001, 1995.

PTCE7021 PREFABRICATED STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To understand the principles of prefabrication, behaviour and design of prefabricated components and structural connections.

UNIT I INTRODUCTION 10

Need for prefabrication - Principles - Materials - Modular co-ordination – Standardization – Systems Production – Transportation – Erection Disuniting of Structures.

UNIT II PREFABRICATED COMPONENTS 10

Behaviour of structural components – Large panel constructions – Construction of roof, floor slabs and Wall panels – Columns – Shear walls.

UNIT III DESIGN PRINCIPLES 10

Design of Structural components – Beam, Column and Corbel - Stress limitations – Handling without cracking, handling with controlled cracking – Design for stripping forces

UNIT IV JOINTS IN STRUCTURAL MEMBERS 8

Joints for different structural connections – Beam to Column, Beam to Beam, Column to Column, Column to Foundation, Connections between wall panels, Connections between floor panels - Dimensions and detailing – Design of expansion joints- Jointing Materials.

UNIT V DESIGN FOR EARTHQUAKES AND CYCLONES 7

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones etc. - Importance of avoidance of progressive collapse.

TOTAL: 45 PERIODS

OUTCOMES:

- The student shall be able to design the prefabricated elements and also have the knowledge of the construction methods in using these elements.

TEXTBOOKS:

1. Koncz T., Manual of Precast Concrete Construction, Vols. I, II and III, Bauverlag, GMBH, 1971.
2. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the Use of Precast Concrete, Netherland Betor Verlag, 1978.
3. Haas. A.M., Precast Concrete Design and Applications,CRC Press,1983.
4. PCI Manual for Structural Design of Architectural Precast Concrete, PCI Publication number MNL-121-77,1977.
5. M.Levitt, “Precast Concrete Material, Manufacture, Properties and Usage” Applied Science Publishers Ltd., 1982.
6. A.S.G. Bruggeling and G.F.Huyghe, Prefabrication with concrete, Netherlands: A.A. Balkema Publishers, 1991.
7. Lasslo Mokk, “Prefabricated Concrete for Industrial and Public Structures Budapest Budapest, Akadémiai Kiadó,publishers, 1964

REFERENCES:

1. Building Materials and Components, CBRI, India, 1990.
2. Glover C.W, Structural Precast Concrete, Asia Publishing House, 1965
3. PCI Design Hand Book, 6th Edition, 2004.

PTCE7022 ROCK ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on fundamentals of rock mechanics and its application in solving simple problems associated with rock slopes and underground openings. Student gains the knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.

UNIT I CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 6

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock Mass Rating and Q System.

UNIT II ROCK STRENGTH AND FAILURE CRITERIA 12

Modes of rock failure – Strength of rock – Laboratory measurement of shear, tensile and compressive strength. Stress - strain behaviour of rock under compression – Mohr -Coulomb failure criteria and empirical criteria

UNIT III INITIAL STRESSES AND THEIR MEASUREMENTS 10

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method

UNIT IV APPLICATION OF ROCK MECHANICS IN ENGINEERING 10

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

UNIT V ROCK STABILISATION 7

Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves – Shotcreting.

TOTAL: 45 PERIODS

OUTCOME:

- Students are capable of classifying the rock. They can understand stares-strain characteristics, failure criteria, and influence of insitu stress in the stability of various structures and also know various technique to improve the insitu strength of rocks.

TEXTBOOKS:

1. Goodman, P.E. “Introduction to Rock Mechanics”, John Wiley and Sons, 1999.
2. Stillborg B., “Professional User Handbook for rock Bolting”, Tran Tech Publications, 1996.
3. Brady, B.H.G. and Brown, E.T., Rock mechanics for underground mining (Third Edition), Kluwer Academic Publishers, Dordrecht, 2006.

REFERENCES:

1. Brown, E.T. “Rock Characterisation Testing and Monitoring”. Pergaman Press 1991.
2. Arogyaswamy, R.N.P., Geotechnical Application in Civil Engineering”, Oxford and IBH, 1991.
3. Hook E.and Bray J., Rock slope Engineering, Institute of Mining and Metallurgy”, U.K. 2004.
4. Ramamurthy. T., “Engineering in Rocks for Slopes, Foundation and Tunnels: (Third Edition), PHI Learning Private Limited, New Delhi, 2014.

PTCE7023 **TALL STRUCTURES** **L T P C**
3 0 0 3

OBJECTIVE:

- To understand the design philosophy of tall buildings, the loading and behaviour of structural systems. To enlighten the students on modern techniques available for the analysis of tall buildings.

UNIT I DESIGN CRITERIA AND MATERIALS 8

Design Philosophy - Modern concepts – Materials used - High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete, Glass, High strength steel.

UNIT II LOADING 9

Gravity Loading – Dead load, Live load – Live load reduction techniques, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads.

UNIT III BEHAVIOUR OF STRUCTURAL SYSTEMS 9

Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, in filled frames, Shear walls, Coupled Shear walls, Wall – Frames, Tubular, Outrigger braced, Hybrid systems.

UNIT IV ANALYSIS 10

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for member forces, drift and twist. Computerized 3D analysis, Evaluation of frequency of vibration of structures – Buckling analysis of tall structures

UNIT V DESIGN PARAMETERS 9

Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

TOTAL: 45 PERIODS

OUTCOMES:

- The student should have an understanding on the behaviour of tall buildings subjected to lateral building. The students should have knowledge about the principles of designing safer tall structures as per the existing codes.

TEXTBOOKS:

1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 1991.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings, McGraw Hill, 1988

REFERENCES:

1. Coull, A. and Smith Staford.B, Tall Buildings , Pergamon Press, London, 1997.
2. LinT.Y. and Burry D.Stotes, Structural Concepts and Systems for Architects and Engineers, John Wiley, 1994.
3. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.
4. Wolfgang Schuler, High Rise Building Structures, John Wiley & Sons, New York, 1977

PTCE7024 TOTAL STATION AND GPS SURVEYING L T P C
3 0 0 3

OBJECTIVE :

- To understand the working of total station equipment and solve the surveying problems.

UNIT I FUNDAMENTALS OF TOTAL STATION AND GPS 9

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler's Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept – GNSS

UNIT II ELECTROMAGNETIC WAVES 9

Classification - applications of Electromagnetic waves, Propagation properties, wavepropagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI- Computation of group for light and near infrared waves at standard and ambient conditions- Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Meanrefractive index- Second velocity correction -Total atmospheric correction- Use of temperature
- pressure transducers.

UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro- optical and Microwave system. Care and maintenance of Total Station instruments. Modern positioning systems – Traversing and Trilateration.

UNIT IV SATELLITE SYSTEM 9

GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT V GPS DATA PROCESSING 9

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data - data processing – software modules -solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -basic constellation of satellite geometry & accuracy measures - applications- long baseline processing- use of different softwares available in the market.

TOTAL : 45 PERIODS

OUTCOME:

- The student shall acquire through working knowledge of modern surveying equipment such as Total Station and GPS so that they will be able to solve all surveying problem faced by our Country.

TEXTBOOKS:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1990.
2. Satheesh Gopi, rasathishkumar, Nmadhu, " Advanced Surveying , Total Station GPS and Remote Sensing " Pearson education , 2007 isbn: 978-81317 00679

REFERENCES :

1. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.
2. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 2003.
3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
4. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 1998

PTCE7025 TRAFFIC ENGINEERING AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To give an overview of Traffic engineering, various surveys to be conducted, traffic regulation, management and traffic safety.

UNIT I TRAFFIC CHARACTERISTICS 10

Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India

UNIT II TRAFFIC SURVEYS 7

Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL 8

Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelisation – Grade separation - Traffic signs and road markings.

UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 10

Road accidents – Causes, effect, prevention, and cost – street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, health effects and abatement measures.

UNIT V TRAFFIC MANAGEMENT 10

Area Traffic Management System – One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options _ Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)- - Introduction to Intelligent Transportation Systems (ITS)- ITS Applications in Traffic Management.

TOTAL: 45 PERIODS

OUTCOME

- Students would have gained knowledge on characteristics of traffic elements, traffic survey, traffic regulation and traffic management measures.

TEXTBOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi,2008.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
4. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

REFERENCES:

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005
2. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
3. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Hobbs. F.D. Traffic Planning and Engineering,University of Brimingham, Peragamon Press Ltd, 1994.

5. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
6. Jason C.Yu Transportation Engineering, Introduction to Planning, Design and Operations, Elseevier, 1992.

PTCE7026 TRANSPORT AND ENVIRONMENT L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to create an awareness / overview of the impact of Transportation Projects on the environment and society..

UNIT I INTRODUCTION 8

Environmental Inventory, Environmental Assessment, Environmental Impact Assessment (EIA), Environmental Impact of Transportation Projects, Need for EIA, EIA Guidelines for Transportation Project, Historical Development.

UNIT II METHODOLOGIES 8

Elements of EIA – Screening and Scoping – Methods of Impact Analysis – Applications – Appropriate methodology.

UNIT III ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT 10

Prediction and Assessment of Impact of Transportation Project at various stages on water, air, noise, land acquisition and resettlement, Socio economic impact, indigenous people, aesthetics, health and safety, energy studies, IRC guidelines.

UNIT IV ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN 10

Mitigation of the impact on Natural and Man-made Environment, Health, Water, Land, Noise, Air, Public participation, Environmental Management Plan, Energy Conservation, Methods to reduce Global Warming.

UNIT V EIA CASE STUDIES 9

EIA Case Studies on Highway, Railway, Airways and Waterways Projects

TOTAL: 45 PERIODS

OUTCOME:

- Students would have understood the impact of Transportation projects on the environment, Environmental Laws on Transportation Projects and the mitigative measures adopted in the planning stage

TEXTBOOKS:

1. Canter, L.R., Environmental Impact Assessment, McGraw Hill, New Delhi, 1996.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, Delhi, 1998.
3. P. Meenakshi, Elements of Environmental Science and Engineering, Prentice Hall of India, New Delhi, 2006
4. Thirumurthy A.M., Introduction to Environmental Science and Management, Shroff Publishers, Bombay, 2005

REFERENCES:

1. John G.Rau and David, C.Hooten, Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1995
2. James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company, 2000
3. World Bank, A Handbook on Roads and Environment, Vol.I and II, Washington DC, 1997
4. Priya Ranjan Trivedi, International Encyclopedia of Ecology and Environment – EIA, Indian Institute of Ecology and Environment, New Delhi, 1998

PTCE7027 TRANSPORTATION PLANNING AND SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To give an exposure on overview of the principles of the bus and rail transportation planning and evaluation of the transportation projects.

UNIT I STUDY AREA AND SURVEYS 10

Importance of planning and integrated transport facilities in urban areas – Delineation of study area and zoning – Conducting various surveys – Travel patterns, transport facilities and planning parameters.

UNIT II MODES 7

Basics of trip generation – Trip distribution – Trip assignment and modal split models – Validation of the model.

UNIT III PLAN PREPARATION AND EVALUATION 8

Preparation of alternative plans – Evaluation techniques – Economic and financial evaluation – Environment Impact Assessment (EIA) – Case Studies.

UNIT IV BUS TRANSPORTATION 10

Characteristics and bus transportation in urban areas – Fare policy – Route planning – Planning of terminals – Break even point and its relevance.

UNIT V RAIL TRANSPORTATION 10

Characteristics of suburban, IRT and RRT systems – Planning of rail terminals – Fare policy – Unified traffic and transport authority.

TOTAL: 45 PERIODS

OUTCOME

- The students would have gained knowledge on comprehensive traffic and transport planning for cities with special emphasis on bus and rail system planning.

TEXTBOOKS:

1. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.
2. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2008.

REFERENCES:

1. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
2. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
3. Juan de Dios Ortúzar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
4. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.

PTCE7028 URBAN PLANNING AND DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:

- To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

UNIT I BASIC ISSUES 8

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II PLANNING PROCESS 8

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-case studies

UNIT IV PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS 9

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM 10

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have the ability to

- describe basic issues in urban planning
- formulate plans for urban and rural development and
- plan and analyse socio economic aspects of urban and rural planning

TEXTBOOKS:

1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986

REFERENCES:

1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2002
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
4. CMDA, Second Master Plan for Chennai, Chennai 2008

PTCE7029 WATER RESOURCES SYSTEMS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the student to the concept of Mathematical approaches for managing the water resources system.
- To make the students apply an appropriate system approach to optimally operate a water resource system.

UNIT I SYSTEM APPROACH 7

Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – scopes and steps in systems engineering.

UNIT II PHYSICAL AND SOCIO - ECONOMIC DATA 6

Collection, evaluation and processing – project appraisal – public involvement, master Comprehensive and integrated planning of water resources project.

UNIT III LINEAR PROGRAMMING 10

Operation research - introduction - Problem Formulation-graphical solution- Simplex method – Sensitivity analysis - simple applications

UNIT IV DYNAMIC PROGRAMMING 11

Optimality criteria Stage coach problem – Bellman's optimality criteria Problem formulation and Solution - simple applications

UNIT V SIMULATION 11

Basic principles – Methodology and Philosophy – Model development – input and outputs – Deterministic simulation - simple applications

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be exposed to the economical aspects and analysis of water resources systems by which they will get an idea of comprehensive and integrated planning of a water resources project.
- The students will develop skills in solving problems in operations research through LP, DP and Simulation techniques.

TEXTBOOK:

1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.

REFERENCES:

1. Hall Warren, A. and John A. Dracup., Water Resources System Engineering, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998
2. Chadurvedi M.C., Water resource Systems Planning and Management, Tata McGraw Hill inc., New Delhi,1997
3. Taha H.A., Operation Research, McMillan Publication Co., New York, 1995.
4. Maass A., Husfchimidt M.M., ,Dorfman R., ThomasH A., Marglin S.A and Fair G.M., Design of Water Resources System, Hardward University Press, Cambridge, Mass.,1995.
5. Goodman Aluvin S., Principles of Water Resources Planning, Prentice-Hall, India 1984.

ANNA UNIVERSITY, CHENNAI – 600 025
UNIVERSITY DEPARTMENTS
R - 2017
B.E. (PART-TIME) MECHANICAL ENGINEERING
I - VII SEMESTER CURRICULA AND SYLLABI
SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTGE7151	Computing Techniques	3	0	0	3
3.	PTCY7151	Engineering Chemistry	3	0	0	3
4.	PTGE7152	Engineering Mechanics	3	0	0	3
5.	PTPH7151	Engineering Physics	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7204	Basic Electrical Engineering and Measurements	3	0	0	3
2.	PTEC7204	Electronics Engineering	3	0	0	3
3.	PTME7201	Engineering Thermodynamics	3	0	0	3
4.	PTCE7204	Fluid Mechanics and Machinery	3	0	0	3
5.	PTMA7251	Numerical Methods	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTGE7153	Environmental Science and Engineering	3	0	0	3
2.	PTME7301	Kinematics of Machines	3	0	0	3
3.	PTME7302	Manufacturing Technology – I	3	0	0	3
4.	PTCE7304	Strength of Materials	3	0	0	3
5.	PTME7303	Thermal Engineering – I	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTME7401	Dynamics of Machines	3	0	0	3
2.	PTML7401	Engineering Materials and Metallurgy	3	0	0	3
3.	PTME7402	Manufacturing Technology–II	3	0	0	3
4.	PTME7403	Thermal Engineering–II	3	0	0	3
PRACTICAL						
5.	PTME7411	Thermal Engineering Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTME7501	Computer Aided Design	3	0	0	3
2.	PTME7502	Computer Integrated Manufacturing	3	0	0	3
3.	PTME7503	Design of Machine Elements	3	0	0	3
4.	PTME7504	Finite Element Analysis	3	0	0	3
5.	PTME7505	Hydraulics and Pneumatics	3	0	0	3
		TOTAL	**12**	**0**	**3**	**15**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTME7601	Design of Transmission Systems	3	0	0	3
2.	PTME7602	Heat and Mass Transfer	3	0	0	3
3.	PTME7603	Metrology and Measurements	3	0	0	3
4.		Elective – I	3	0	0	3
PRACTICAL						
5.	PTME7611	Simulation and Analysis Laboratory	0	0	3	2
		TOTAL	**15**	**0**	**0**	**14**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTME7701	Mechatronics	3	0	0	3
2.	PTME7751	Power Plant Engineering	3	0	0	3
3.		Elective – II	3	0	0	3
PRACTICAL						
4.	PTME7711	Project Work	0	0	9	6
		TOTAL	**9**	**0**	**9**	**15**

TOTAL NO. OF CREDITS: 15+15+15+14+14+15+15 = 103

ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMF7001	Additive Manufacturing Technology	3	0	0	3
2.	PTME7001	Advanced Internal Combustion Engineering	3	0	0	3
3.	PTME7002	Automobile Engineering	3	0	0	3
4.	PTME7003	Casting and Welding Processes	3	0	0	3
5.	PTME7004	Composite Materials and Mechanics	3	0	0	3
6.	PTME7005	Computational Techniques for Fluid Dynamics	3	0	0	3
7.	PTME7006	Design for Manufacturing	3	0	0	3
8.	PTME7007	Design of Heat Exchangers	3	0	0	3
9.	PTME7008	Design of Jigs, Fixtures and Press Tools	3	0	0	3
10.	PTME7009	Design of Pressure Vessel and Piping	3	0	0	3
11.	PTGE7071	Disaster Management				
12.	PTME7010	Energy Conservation in Industries	3	0	0	3
13.	PTGE7072	Engineering Ethics and Human Values	3	0	0	3
14.	PTME7011	Entrepreneurship Development	3	0	0	3
15.	PTGE7076	Fundamentals of Nano Science				
16.	PTME7012	Gas Dynamics and Space Propulsion	3	0	0	3
17.	PTGE7073	Human Rights				
18.	PTME7013	Introduction to Operations Research	3	0	0	3
19.	PTGE7075	Intellectual Property Rights				
20.	PTME7014	Marketing Management	3	0	0	3
21.	PTPH7152	Materials Science	3	0	0	3
22.	PTME7015	Mechanical Vibrations and Noise Control	3	0	0	3
23.	PTME7016	MEMS and Micro System	3	0	0	3
24.	PTME7017	New and Renewable Sources of Energy	3	0	0	3
25.	PTME7018	Nondestructive Materials Evaluation	3	0	0	3
26.	PTMF7002	Non-traditional Machining Processes	3	0	0	3
27.	PTMA7071	Probability and Statistics	3	0	0	3
28.	PTME7019	Process Planning and Cost Estimation	3	0	0	3
29.	PTME7020	Product Design and Development	3	0	0	3
30.	PTME7021	Refrigeration and Air-conditioning	3	0	0	3
31.	PTML7001	Reliability Concepts in Engineering	3	0	0	3
32.	PTME7022	Theory of Metal Forming	3	0	0	3
33.	PTGE7074	Total Quality Management	3	0	0	3
34.	PTME7023	Turbo Machinery	3	0	0	3

PTMA7151 **APPLIED MATHEMATICS** **L T P C**

(Common to all branches of B.E / B.Tech (PT) Programmes) **3 0 0 3**

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES 9

Characteristic equation – Eigen values and Eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION 9

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS 9

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUT COMES :

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTGE7151	COMPUTING TECHNIQUES	L	T	P	C
	(Common to all branches of Engineering and Technology)	**3**	**0**	**0**	**3**

OBJECTIVE

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures - Unions

TOTAL : 45 PERIODS

OUTCOME

At the end of the course, the student should be able to:

- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort**.**
- Use programming language to solve problems.

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Byron S Gottfried, “Programming with C”, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007

PTCY7151	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVE

- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRYAND CATALYSIS 9

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions-Types of isotherms–Frendlich adsorption isotherm, Langmuir adsorption isotherm. Industrial applications of adsorption. Catalysis: Characteristics and types of catalysts-homogeneous and heterogeneous, auto catalysis. Enzyme catalysis -factors affecting enzyme catalysis, Michaelis-Menton equation. Industrial applications of catalysts

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry-Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes-internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV CHEMICAL THERMODYNAMICS 9

Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANOCHEMISTRY 9

Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Preparation of nanoparticles – sol-gel and solvothermal. Preparation of carbon nanotube by chemical vapour deposition and laser ablation.Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning.Properties and uses of nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

TOTAL: 45 PERIODS

OUTCOMES:

- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXTBOOKS:

1. Jain P. C. & Monica Jain., "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd, New Delhi, 2014.
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014

REFERENCES:

1. Pahari A., Chauhan B., "Engineering Chemistry", Firewall Media, New Delhi, 2012.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. AshimaSrivastava. Janhavi N N, Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
4. Vairam S., Kalyani P., Suba Ramesh., "Engineering Chemistry", Wiley India Pvt Ltd., New Delhi., 2011.

PTGE7152 ENGINEERING MECHANICS L T P C

3 0 0 3

OBJECTIVES:

The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I STATICS OF PARTICLES 9

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle-Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point ,Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple-Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force-Couple system, Further Reduction of a System of
Forces, Equilibrium in Two and Three Dimensions-Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES 9

Centroids of lines and areas –symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies ,Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass -Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass-Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION 9

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance , Ladder friction.

UNIT V DYNAMICS OF PARTICLES 9

Kinematics-Rectilinear Motion and Curvilinear Motion of Particles. Kinetics-Newton's Second Law of Motion -Equations of Motions , Dynamic Equilibrium, Energy and Momentum Methods Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact.

TOTAL: 45 PERIODS

OUTCOME:

Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw-Hill Education (India) Pvt. Ltd. 10th Edition, 2013.

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
2. J.L. Meriam& L.G. Karige, Engineering Mechanics: Statics (Volume I) and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
3. P. Boresi& J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008. Irving H. Shames, G. Krishna MohanaRao, Engineering Mechanics -Statics andDynamics, Fourth Edition–PHI / Pearson Education Asia Pvt. Ltd., 2006.
4. Vela Murali, "Engineering Mechanics", Oxford University Press 2010.

PTPH7151 **ENGINEERING PHYSICS** **L T P C**

(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

OBJECTIVE:

- To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Poisson's ratio and relationship between moduli (qualitative) - stress-strain diagram for ductile and brittle materials, uses - factors affecting elastic modulus and tensile strength - bending of beams - cantilever - bending moment - Young's modulus determination - theory and experiment - uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - calculation of reverberation time for different types of buildings – sound absorbing materials - factors affecting acoustics of buildings : focussing, interference, echo, echelon effect, resonance - noise and their remedies. Ultrasonics: production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating – ultrasonic interferometer - industrial applications – Non-destructive testing - ultrasonic method: scan modes and practice.

UNIT III THERMAL AND MODERN PHYSICS 9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media - Forbe's and Lee's disc method: theory and experiment- Black body radiation – Planck's theory (derivation) – Compton effect – wave model of radiation and matter – Schrödinger's wave equation – time dependent and independent equations – Physical significance of wave function – particle in a one dimensional box.

UNIT IV APPLIED OPTICS 9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its applications - Lasers – principle and applications – Einstein's coefficients – CO_2 and Nd:YAG laser - semiconductor lasers: homo junction and hetro junction - construction and working – applications. Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

OUTCOME:

- The students will acquire knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXTBOOKS:

1. Gaur R.K. and Gupta S.L., “Engineering Physics”, Dhanpat Rai Publications (2013)
2. Palanisamy P.K., “Engineering Physics”, Scitech Publications (P) Ltd. (2006).
3. Arumugam M., “Engineering Physics”, Anuradha Publications (2000)

REFERENCES:

1. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co. (2010).
2. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”. W.H.Freeman, (2007).
3. Markert J.T.,Ohanian, H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W.Norton & Co. (2007).

PTEE7204	BASIC ELECTRICAL ENGINEERING AND MEASUREMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on

- Electric circuit laws
- Principle of Electrical Machines
- Various measuring instruments

UNIT I ELECTRICAL CIRCUITS 9

Ohms Law – Kirchhoff’s Law-Mesh analysis – Superposition and Thevenin’s theorem - Introduction to AC circuits – waveforms, RMS and average value – Power and power factor-Three phase balanced circuits-Three phase Power measurement.

UNIT II ELECTRICAL MACHINES 9

Principle of operation DC machines- Characteristics of DC motor - Single phase transformers, three-phase and single-phase induction motors – Speed Control.

UNIT III SPECIAL ELECTRICAL COMPONENTS 9

Synchronous machine – Brushless DC Motor - Stepper motor – Switched reluctance motor-Electromechanical Relays.

UNIT IV ELECTRICAL MEASUREMENTS 9

Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type wattmeters – Energy meter – Megger – Instrument transformers (CT & PT) –Wheatstone’s bridge for measurement of unknown resistance ,Maxwell’s bridge for unknown inductance and Schering Bridge for unknown capacitance –Instrumentation Amplifiers.

UNIT V MECHANICAL MEASUREMENTS 9

Classification of transducers, strain, RTD, thermocouples, Piezo-electric transducer, LVDT, Turbine and electromagnetic flow meters, level transducers ultrasonic and fiber optic transducers, type of sensors, elastic sensors, viscosity, moisture and pH sensors, Digital transducers, vibrating wire instruments like load cells, stress meter, etc.

TOTAL : 45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Explain different types of electrical machines and their performance.

TEXT BOOKS:

1. Del Toro 'Electrical Engineering Fundamentals' Pearson Education, New Delhi, 2007.
2. Alan S. Moris, Principles of Measurements and Instruments, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
3. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon 125 press, London, 1988.
4. Sunil S.Rao, Switchgear and Protection, Khanna publishers, New Delhi, 2008.

REFERENCES:

1. Rajendra Prasad 'Fundamentals of Electrical engineering' Prentice Hall of India, 2006.
2. Sanjeev Sharma 'Basics of Electrical Engineering' S.K International Publishers, New Delhi 2007.
3. John Bird, Electrical Circuits theory and Technology, Elsevier, First India Edition, 2006.
4. Doebeling, E.O., Measurements Systems – Application and Design', McGrawHill Publishing Co, 1990.
5. D.P.Kothari and I.J.Nagrath, Electric machines, Tata Mc Graw hill publishing company, New Delhi, Third Edition, 2004.

PTEC7204 ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide knowledge in the basic concepts of Electronics Engineering including semiconductors, transistors, electronic devices, signal generators, transducers and digital electronics.

UNIT I SEMICONDUCTORS AND RECTIFIERS 9

P-N junction, VI Characteristics of PN junction diode, Zener diode, Zener diode Characteristics, Zener diode as a regulator, BJT and N-MOSFET working and V-I characteristics.

UNIT II AMPLIFIERS AND OSCILLATORS 9

BJT CE amplifier with and without feedback and frequency response, CS MOSFET amplifier and its frequency response, Current series feedback amplifier. Positive feedback, Sinusoidal oscillators – Wein bridge oscillators, Hartley, Colpitts, and Crystal oscillator.

UNIT III LINEAR INTEGRATED CIRCUITS 9

Operational amplifier –Inverting and Non-inverting amplifiers, Adder, integrator and differentiator, Instrumentation amplifier, Digital to Analog converters - R-2R and weighted resistor types, Analog to Digital converters - Successive approximation and Flash types, IC 555 based Astable and Monostable Multivibrators,

UNIT IV DIGITAL ELECTRONICS 9

Boolean algebra, Logic Gates, Half and Full adders, Decoder, Encoder, Multiplexer, Demultiplexer, Flip flops, Counters and Registers.

UNIT V TRANSDUCERS AND DISPLAY DEVICES 9

Thermistors, Semiconductor strain gauges, LVDT, Tachometer, Ultrasonic and Thermal flow meter, pressure force and weight measurement, Seven segment display, LED and LCD

TOTAL : 45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Identify and apply electronics components to design circuits.

TEXT BOOK:

1. Malvino, 'Electronic Principles', McGraw Book Co., 1993.

REFERENCES:

1. Grob. B and Schultz. M.E. 'Basic Electronics', Tata Mcgraw Hill, 2003.
2. Thomas L. Floyd, 'Electronics Devices', Pearson Education, 2002.
3. Thomas L. Floyd, 'Digital Fundamentals', Pearson Education, 2003.
4. Millman, Halkias Jacob, Jit Christos and Satyabrata, 'Electronic devices and Circuits', Tata McGraw Hill, 2 nd Edition.
5. Transducers in Mechanical and Electronic Design by Trietley

PTME7201 ENGINEERING THERMODYNAMICS L T P C
3 0 0 3

OBJECTIVE:

- To train the students on the basics and applications of energy in Mechanical Engineering

UNIT I BASIC CONCEPTS AND FIRST LAW 9

Basic concepts - continuum, Microscopic and Macroscopic approaches. Path and point functions. Intensive and extensive properties, total and specific quantities. System, surrounding, boundary and their types. Thermodynamic Equilibrium. State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer - definition and comparison, sign convention. Displacement work, P-V diagram. Zeroth law. First law – application to closed and open systems.

UNIT II SECOND LAW 9

Heat Reservoir - source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle, Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations - entropy change for different processes, principle of increase in entropy. Applications of II Law. Availability and Irreversibility analysis for open and closed systems.

UNIT III PURE SUBSTANCES AND STEAM POWER CYCLE 9

Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart. Ideal and actual Rankine cycles.

UNIT IV IDEAL AND REAL GASES THERMODYNAMIC RELATIONS 9

Properties of Ideal gas, real gas, and their comparison. Equations of state for ideal and real gases. van der Waal's relation, Compressibility factor, Principle of Corresponding states. Generalised Compressibility Chart and its use. Maxwell relations, Tds Equations, heat capacities relations, Energy equation, Joule-Thomson experiment, Clausius-Clapeyron equation.

UNIT V GAS MIXTURES AND PSYCHROMETRY 9

Mole and mass fractions – Dalton's and Amagat's laws, properties of ideal gas mixtures. Psychrometric properties – Property calculations using Psychrometric chart and expression Psychrometric processes and simple applications.

TOTAL : 45 PERIODS

(Use of Steam tables, Mollier chart and Psychrometric chart permitted)

OUTCOMES:

Upon completion of this course, the students will be able to:

- Thermodynamic principles to Engineering Applications.
- Apply mathematical fundamentals to study the properties of steam, gas and gas mixtures.

TEXT BOOKS:

1. Nag.P.K, “Engineering Thermodynamics”, 5th Edition, Tata McGraw Hill (2013), New Delhi.
2. Natarajan .E, “Engineering Thermodynamics: Fundamentals and Applications”, 2nd Edition(2014) Anuragam Publications, Chennai.

REFERENCES:

1. Y. Cengel and M. Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill,7th Edition, 2011.
2. Chattopadhyay, P, “Engineering Thermodynamics”,2nd Ed. Oxford University Press, 2014
3. Venkatesh. A, “Basic Engineering Thermodynamics”, Universities Press (India) Limited, 2007
4. E. Rathakrishnan, “Fundamentals of Engineering Thermodynamics”, 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.
5. Van Wylen and Sonntag, “Classical Thermodynamics”, Wiley Eastern, 1987.
6. Arora .C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill, 1994

PTCE7204	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the applications of the conservation laws to flow through pipes and hydraulic machines.
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension. Flow characteristics – concept of control volume - application of control volume to continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 9

Impact of jets - Euler's equation - Theory of roto dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – indicator diagram – work saved by fitting air vessels – Rotary pumps – classification – comparison of working principle with other pumps – advantages.

UNIT V TURBINES 9

Classification of turbines – heads and efficiencies – velocity triangles – axial, radial and mixed flow turbines – Pelton wheel and Francis turbine - working principles - work done by water on the runner – draft tube - specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Critically analyse the performance of pumps and turbines.

TEXT BOOKS:

1. Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co.(2010)
2. Kumar K. L., Engineering Fluid Mechanics, Eurasia Publishing House(p) Ltd. New Delhi (2004).
3. Modi P.N. and Seth, S.M. Hydraulics and Fluid Mechanics, Standard Book House (2002), New Delhi

REFERENCES:

1. Robert .Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", ISBN 978-0-470-54755-7, 2011.

PTMA7251 NUMERICAL METHODS L T P C
3 0 0 3

OBJECTIVES :

- To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton -Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 9

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first and second order equations – Multi step methods - Milne's and Adams - Bashforth predictor - corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference methods for solving two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat - flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL : 45 PERIODS

OUT COMES :

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS :

1. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Burden, R.L and Faires, J.D, " Numerical Analysis " 9th Edition, Cengage Learning, 2016.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.
4. S. R. K. Iyengar, R. K. Jain, Mahinder Kumar Jain, "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New Age International Publishers, New Delhi, 2012.
5. Sankara Rao . K, " Numerical Methods for Scientists and Engineers", PHI Learning Pvt Ltd. New Delhi, 2007.

PTGE7153 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

To the study of nature and the facts about environment.

- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c)Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards– soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act– Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL:45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia',Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

PTME7301	KINEMATICS OF MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system/ machine.
- To understand the principles in analysing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains.

UNIT I BASIC CONCEPTS 9

Introduction- resistant bodies- kinematic link- kinematic pair- kinematics constraints- kinematic chain- mechanism- structure – Inversion of four bar chain- inversion of single slider crank chain – inversion of double crank chain – Grashof's law – Degrees of freedom – Kutzbach criterion – Grubler's criterion.

UNIT II MECHANISMS 9

Classification of mechanisms- Ratchets and Escapement mechanisms- Indexing mechanisms- Analysis of Hooke's joint – Double Hooke's joint- Pantograph – Straight line motion Mechanisms (Exact and Approximate)- Steering gear mechanisms.

UNIT III KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of mechanisms – Velocities and accelerations by relative velocity method -Velocity analysis using instantaneous centre method- Velocities and accelerations by Analytical method -Coriolis Acceleration.

UNIT IV KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – law of cams-Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic, Cycloidal – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT V GEARS AND GEAR TRAINS 9

Law of gearing – Spur Gear terminology and definitions – Involutes and cycloidal tooth profiles Gear tooth action – Contact ratio – Interference and undercutting – corrected and uncorrected gear teeth – Gear terminology and definitions -Helical, Bevel, Worm, Rack and Pinion gears– Gear trains – Speed ratio, train value – Epicyclic Gear Trains – Differentials – Automobile gear box.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Apply the fundamentals of mechanisms and analyze new mechanisms.

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms",3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3 rd Edition, CBS Publishers and Distributors, 2005.
2. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2010.
3. Sadhu Singh, Theory of machines, Pearson, 2013
4. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
5. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
6. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
7. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
8. Khurmi, R.S.,"Theory of Machines",14th Edition, S Chand Publications 2015.

PTME7302	MANUFACTURING TECHNOLOGY – I	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce the students to the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I METAL CASTING PROCESSES 9

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – Centrifugal Casting - CO casting - Defects in Sand casting process – Stir casting - Defects in Sand casting.

UNIT II METAL JOINING PROCESSES 9

Fusion welding processes – Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding, Electrodes, Coating and specifications – Principles and types of Resistance welding – Gas metal arc welding – Submerged arc welding – Electro slag welding – Gas Tungsten arc welding – Principle and application of special welding processes – Plasma arc welding – Thermit Welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering – methods and process capabilities – Adhesive bonding, Types and application.

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the processes – Typical forging operations – rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes - Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming.

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the different manufacturing process and use this in industry for component production.

TEXT BOOKS:

1. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2006
2. S. Gowri P. Hariharan, A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.

REFERENCES:

1. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2. Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997.
3. Paul Degarma E, Black J.T and Ronald A. Kosher, Eligth Edition, Materials and Processes, in Manufacturing prentice – Hall of India, 1997.
4. Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004. 5. P.N. Rao, Manufacturing Technology Foundry, Forming and Welding, TMH-2003; 2 nd Edition, 2003.

PTCE7304	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumertric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9

Double Integration method – Macaulay’s method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

9

UNIT V THIN CYLINDERS, SPHERES AND THICk CYLINDERS

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theory – Application of theories of failure.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOkS:

1. Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2007.
2. Jindal U.C., Strength of Materials, Asian Books Pvt. Ltd., New Delhi, 2007.

REFERENCES:

1. Egor. P.Popov " Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., Strength of Materials, oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., Mechanics of Materials, Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole Mechanics of Materials, Tata Mcgraw Hill publishing 'co. Ltd., New Delhi.

PTME7303	THERMAL ENGINEERING - I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply the concepts and laws of thermodynamics for cycle analysis and performance of heat engines - Internal Combustion(IC) engines and Gas Turbines.
- To get an insight on the working and performance of air compressors
- To understand the working of various auxiliary systems present in IC engines.

UNIT I GAS AND STEAM POWER CYCLES 9

Air Standard Cycles - Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison – Rankine, reheat and regenerative cycle.

UNIT II RECIPROCATING AIR COMPRESSOR 9

Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.

UNIT III INTERNAL COMBUSTION ENGINES AND COMBUSTION 9

IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.

UNIT IV INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS 9

Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common Rail Direct Injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms.

UNIT V GAS TURBINES 9

Gas turbine cycle analysis – open and closed cycle. Performance and its improvement - Regenerative, Intercooled, Reheated cycles and their combinations. Materials for Turbines.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Analyse the theory and performance of air-standard cycles
- Understand functioning and performance of IC engines and its sub systems
- Understand the working of Gas turbines and their performance

TEXT BOOKS:

1. Mahesh. M. Rathore, “Thermal Engineering”, 1st Edition, Tata McGraw Hill, 2010.
2. Ganesan.V , " Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. Rudramoorthy R, “Thermal Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Holman .J.P., “Thermodynamics”, McGraw Hill, 1985.
3. Rajput .R.K, “Thermal Engineering”, Laxmi, 8th Edition, 2013.

PTME7401 DYNAMICS OF MACHINES L T P C
3 0 0 3

OBJECTIVES:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the effects of unbalances resulting from prescribed motions in mechanisms.
- To understand the fundamentals of vibrations.
- To understand the principles in mechanisms used for governing of machines.

UNIT I FORCE ANALYSIS 9

Applied and constraint forces – Free body diagrams – Static equilibrium conditions – force equilibrium analysis of simple mechanisms - friction in mechanisms– Dynamic force analysis – Inertia force and Inertia torque – D Alembert’s principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams – Flywheels for engines and punching presses.

UNIT II BALANCING 9

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline engines, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines- Balancing standards - Field balancing of single disc.

UNIT III FREE VIBRATION 9

Basics of vibratory systems – Degrees of freedom – Natural frequency -Spring mass system- Equations of motion –– Viscously damped free vibration- Logarithmic decrement- Transverse vibration – Dunkerley's method- Critical speed of shafts -Two and three rotor torsional vibration.

UNIT IV FORCED VIBRATION 9

Response of one degree freedom system to Harmonic excitation force – Vibration Isolation - rotating unbalance - support motion – Transmissibility - Energy dissipated by damping- Vibration measuring instruments.

UNIT V MECHANISMS FOR CONTROL 9

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force. Gyroscopes – Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Analyse the forces acting in a mechanical system and related vibration issues.

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms",3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3 rd Edition, CBS Publishers and Distributors, 2005.
2. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
3. Ghosh. A andMallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
4. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
5. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996
6. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
7. Khurmi, R.S.,"Theory of Machines",14th Edition, S Chand Publications 2015

PTML7401 ENGINEERING MATERIALS AND METALLURGY L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge on construction of phase diagrams and also the importance of iron-iron carbide phase diagram.
- To impart knowledge on different heat treatment processes used in industries and the basics behind the microstructure formation.
- To impart knowledge on the properties and applications of various engineering materials.
- To expose testing methods and procedures to find the mechanical properties of engineering materials.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – Iron carbide phase diagram. Classification of steel and cast Iron- microstructure, properties and application.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief annealing, recrystallisation annealing and spheroidising – normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – Continuous Cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability, Jominy end quench test -case hardening, carburizing, nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementary ideas on sintering.

UNIT III FERROUS AND NON-FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal and alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based superalloys –Properties and Applications.

UNIT IV NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS,PAI, PPO, PPS, PEEK, PTFE, Thermo set polymers – Urea and Phenol formaldehydes - Engineering Ceramics – Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON – Composites- Matrix and reinforcement Materials- applications of Composites - Nano composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test - Izod and Charpy, Fatigue and Creep failure mechanisms.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Understand the phase diagrams and relate to the heat treatment processes.
- Tailor structure-property correlations to engineering materials.
- Select proper engineering materials for various engineering applications.
- Perform various testing's to find the properties of engineering materials.

TEXT BOOKS:

1. Sydney H.Avner, “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994
2. Kenneth G.Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint 2002.

REFERENCES:

1. Rahavan.V, “Materials Science and Engineering”, Prentice Hall of India Pvt.Ltd. 1999.
2. G.S. Upadhyay and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt.Ltd, New Delhi, 2006.
3. Williams D Callister, “Materials Science and Engineering” Wiley India Pvt Ltd, Revised Indian edition 2007.

PTME7402 MANUFACTURING TECHNOLOGY – II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming.

UNIT I THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal, oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle: Swiss type, automatic screw type – multi spindle.

UNIT III RECIPROCATING, MILLING AND GEAR CUTTING MACHINES 9

Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutter– machining time calculations - Gear cutting, gear hobbing and gear shaping – gear finishing methods.

UNIT IV ABRASIVE PROCESSES AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods - Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines.

UNIT V COMPUTER NUMERICAL CONTROL MACHINE TOOLS 9

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre and part programming fundamentals – manual part programming and computer assisted part programming.

TOTAL: 45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Understand and compare the functions and applications of different metal cutting operations, machine tools and gain knowledge in programming of CNC machines.

TEXT BOOKS:

1. Roy. A.Lindberg, "Process and materials of manufacture," PHI/Pearson Education fourth, Edition 2006.
2. Serope Kalpakjian, Steven Schmid, "Manufacturing processes for engineering materials", Pearson Education, 3rd Edition, 2009.

REFERENCES:

1. Richerd R Kibbe, John E. Neely, Roland O.Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998
2. HMT – "Production Technology", Tata McGraw Hill, 1998.
3. Hajra Choudhury. "Elements of Workshop Technology – Vol.II". Media Promoters
4. Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", McGraw Hill, 1984
5. Rao. P.N "Manufacturing Technology," Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2003.

PTME7403 THERMAL ENGINEERING - II L T P C
3 0 0 3

OBJECTIVES:

- To apply the thermodynamic concepts for systems like Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

UNIT I STEAM NOZZLE 9

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT II BOILERS 9

Types and comparison. Mountings and Accessories. Fuels - Solid, Liquid and Gas. Performance calculations, Boiler trial.

UNIT III STEAM TURBINES 9

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY 9

Cogeneration Principles, Cycle Analysis, Applications, Source and utilisation of residual heat. Heat pipes, Heat pumps, Recuperative and Regenerative heat exchangers. Economic Aspects.

UNIT V REFRIGERATION AND AIR – CONDITIONING 9

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Understand the working of Nozzles, Boilers & Steam Turbines and their performance
- Understand cogeneration, its types, source of residual heat and their utilising techniques
- Understand the working of Refrigeration & Air- conditioning systems and perform cooling load calculations to determine heating loads

TEXT BOOKS:

1. Mahesh. M. Rathore, "Thermal Engineering", 1st Edition, Tata Mc Graw Hill Publications, 2010.
2. Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V.,"A course in Thermal Engineering", Dhanpat Rai & Sons, 7th Edition, 2010.

REFERENCES:

1. Ballaney. P.L ." Thermal Engineering", Khanna publishers, 24th Edition 2012
2. Arora .C.P., "Refrigeration and Air Conditioning", Tata Mc Graw Hill, 1994
3. Donald Q. Kern, " Process Heat Transfer", Tata Mc Graw Hill, 1997.
4. Charles H Butler : Cogeneration" McGraw Hill, 1984.
5. Sydney Reiter "Industrial and Commercial Heat Recovery Systems" Van Nostrand
6. Reinhols, 1985.
7. David Gunn, Robert Horton, "Industrial Boilers – Longman Scientific and Technical"
8. Publication, 1986.

PTME7411 THERMAL ENGINEERING LABORATORY L T P C
0 0 3 2

OBJECTIVES:

To understand the working of a thermal equipments like IC engines, compressor, and refrigeratior

IC ENGINES LAB

1. Valve timing on a four stroke SI and CI engine
2. Port Timing of a Two stroke SI engine
3. Performance test on a CI engine with electrical loading
4. Performance test on a SI engine with electrical loading
5. Performance Test on a Multi-stage Reciprocating Air Compressor

HEAT TRANSFER LAB:

1. Determination of Thermal conductivity of a composite wall
2. Effectiveness of Parallel / counter flow heat exchanger
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Heat transfer from pin-fin apparatus (natural & forced convection modes)
6. Determination of COP of a vapour compression refrigeration system

TOTAL: 30 PERIODS

PTME7501	COMPUTER AIDED DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand fundamental concepts of computer graphics and its tools in a generic framework.
- To provide clear understanding of CAD systems for 3D modeling and viewing.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9

Product cycle- Design process - Computer Aided Design – Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - graphic primitives (point, line, circle drawing algorithms) - Clipping- viewing transformation.

UNIT II GEOMETRIC MODELING 9

Representation of curves - Hermite cubic spline curve, Bezier curve, B-spline curves, Surface Modeling – Surface Entities, Representation of Surface, Bezier Surface, B-Spline Surface and Coons Surface. Solid Modeling - Solid Entities, Solid Representation, Boundary Representation (B-Rep), Sweeps Representation, Constructive Solid Geometry (CSG).

UNIT III VISUAL REALISM 9

Need for hidden surface removal, The Depth - Buffer Algorithm, Properties that help in reducing efforts, Scan Line coherence algorithm, Span - Coherence algorithm, Area-Coherence Algorithms, Warnock's Algorithm, Priority Algorithms– shading – colouring – computer animation.

UNIT IV PART ASSEMBLY 9

Mass properties - Assembly modeling – Inference of position and orientation –Geometric Dimensioning and Tolerancing – Functional importance of various types of fits, Geometrical dimensioning and Tolerancing, Tolerance stacking – types and remedies.

UNIT V CAD STANDARDS 9

Standards for computer graphics- Graphical Kernel System (GKS) - Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, ACIS and DXF - communication standards.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Understand the various stages in the design process and the role of computer graphic communication process.
- Understand the mathematics behind the use of computer for modeling of mechanical components

TEXT BOOK:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007

REFERENCES:

1. Chris McMahon and Jimmie Browne "CAD/CAM Principles, practice and manufacturing management "Pearson education Asia, 2001.
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker "Computer Graphics"'. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes – "Computer graphics principles & practice", Pearson Education - 2003.

PTME7502	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the application of computers in various aspects of Manufacturing viz., Design, Planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION 9

Various phases in Product Design and CAD, CAM, Concepts of CAD/CAM – CIM concepts and elements – Types of production – Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING & CONTROL AND COMPUTERISED PROCESS PLANNING 9

Process planning – Computer Aided Process Planning (CAPP) – Aggregate Production Planning and Master Production Schedule – Material Requirement Planning (MRP I) – Simple Problems – Capacity Planning – Shop Floor Control – Inventory Control – EOQ, WIP costs & Inventory Holding Costs - Simple Problems – Introduction to Manufacturing Resource Planning (MRP II) & Enterprise Resource Planning (ERP).

UNIT III CELLULAR MANUFACTURING 9

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in OPITZ Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing –Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Implementation Issues – Quantitative analysis of Bottleneck Model on simple problems in FMS. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS 9

Robot Anatomy and Related Attributes – Classification - Control systems – End Effectors – Sensors – Applications – Basics of Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

TOTAL: 45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Acquire the required capability to gradually convert Traditional Manufacturing environment to Computer Integrated Manufacturing environment.

TEXT BOOK:

1. Mikell .P. Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2009.

REFERENCES:
1. Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall India,2003.
2. Radhakrishnan P, Subramanyan S.and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.
3. Gideon Halevi and Roland Weill, “Principles of Process Planning – A Logical Approach” Chapman & Hall, London, 1995.
4. P Rao, N Tewari and T.K. Kundra, “Computer Aided Manufacturing”, Tata McGraw Hill Publishing Company, 2000 .

PTME7503 DESIGN OF MACHINE ELEMENTS L T P C
3 0 0 3

OBJECTIVES
- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties – Stresses in members subjected to axial, shear, Bending, Torsional & Eccentric loading. Uniaxial, Biaxial & Triaxial stress state, Principal Stresses in members subjected to combination of static loads.

Theories of Failure Criterion - Types of variable/Cyclic loads, Fatigue Failure, Endurance Limit & Strength, S-N Diagram. Goodman and Soderberg criterion, Modifying factors: Size effect, surface effect, Reliability, stress concentration effects etc.

UNIT II CURVED BEAMS , SHAFTS AND COUPLINGS 9

Differences between Straight & curved beam,Stresses in curved Beams subjected to Direct and Bending loading of Standard cross sections (Circular, Rectangular, Trapezium, Triangle, I & T Sections) used in crane hook, punching presses & clamps , Closed rings & chain links

Types of shafts- Design of solid & hollow shaft on strength and rigidity basis - Design of shafts carrying pulleys & gears (Combined loading). ASME Code for shaft design.

Types of coulings -Design of muff and flange couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9

Design of Bolted and riveted joints for structures including eccentric loading- Design of Welded joints, Strength of Butt, parallel, transverse welds, eccentrically loaded welded joint subjected to torsion & bending moment.

UNIT IV ENERGY STORING ELEMENTS 9

Types and materials of Springs, Terms used in Compression Springs, Stresses in helical spring of circular wire, deflection of helical spring of circular wire, Energy stored in helical spring of circular wire, helical spring subjected to fatigue loading, spring, leaf spring, construction of leaf spring, equalized stresses in spring leaves, length of leaf spring leaves - Flywheels considering stresses in rims and arms for engines and punching machines.

UNIT V BEARINGS 9

Lubricants and their properties, Modes of Lubrication (Hydrodynamic & Hydrostatic)-Sliding Contact bearings-Journal bearing, Terminology, Bearing Modulus, Minimum oil film thickness. Coefficient of Friction, Summerfield number, Heat generated & Dissipated. Design of journal bearing using Petroff's ,McKee's equation and Raymond & Boyd charts, tables.

Rolling contact bearings :Types & classification, Terminology-Life, Static & dynamic load capacity, equivalent load, Load-life relationship, Design –finding Life, selection from manufacturer's catalogue

TOTAL: 45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

OUTCOMES:

Upon completion of this course, the students can able to successfully design machine components

TEXT BOOK:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.

REFERENCES:

1. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Joseph Shigley,Charles Mischke,Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill , 2008.
3. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design",4th Edition,Wiley, 2005
4. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill Book Co.(Schaum's Outline), 2010
5. Bernard Hamrock,Steven Schmid,Bo Jacobson, "Fundamentals of Machine Elements", 2nd Edition, Tata McGraw-Hill Book Co., 2006.

STANDARDS:

1. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 :
2. Construction.
   IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.
3. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

PTME7504	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of Mathematical Modeling and numerical solution of engineering problems.
- To appreciate the use of Finite Element Method to a range of engineering problems.

UNIT I INTRODUCTION 9

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 9

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics including thermal stresses-heat transfer. Natural frequencies of longitudinal vibration and mode shapes. Fourth Order Beam Equation –Transverse deflections and Transverse Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements and Quadrilateral elements- Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Constitutive matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS 9

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software- Introduction to Non Linearity.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Understand the use of the FEM to solve problems in Mechanical Engineering.
- Use the Finite Element Method to solve Structural, thermal and Eigen value problems.

TEXT BOOKS:

1. J.N.Reddy, “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGrawHill,2005
2. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., NewDelhi, 2007.

REFERENCES:

1. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002.
2. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.
3. Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butter worth Heinemann, 2004.
4. Chandrupatla and Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall, 1990.
5. David Hutton, “Fundamentals of Finite Element Analysis” McGrawHill, 2005
6. Dhanaraj. R and Prabhakaran Nair. K, “Finite Element Analysis”, Oxford Publications, 2015.

PTME7505 HYDRAULICS AND PNEUMATICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
- To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.
- To develop a measurable degree of competence in the design, construction and operation of fluid power circuits.

UNIT I FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

UNIT III HYDRAULIC CIRCUITS AND SYSTEMS 9

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Identify hydraulic and pneumatic components and its symbol and usage.
- Ability to design hydraulic and pneumatic circuits.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Prentice Hall, 2009.
2. James A. Sullivan, "Fluid Power Theory and Applications", Fourth Edition, Prentice Hall, 1997.

REFERENCES:
1. Shanmugasundaram.K, “Hydraulic and Pneumatic Controls”. Chand & Co, 2006.
2. Majumdar, S.R., “Oil Hydraulics Systems – Principles and Maintenance”, Tata McGRaw Hill, 2001.
3. Majumdar, S.R., “Pneumatic Systems – Principles and Maintenance”, Tata McGRaw Hill, 2007.
4. Dudley, A. Pease and John J Pippenger, “Basic Fluid Power”, Prentice Hall, 1987
5. Srinivasan.R, “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008
6. Joshi.P, Pneumatic Control”, Wiley India, 2008.
7. Jagadeesha T, “Pneumatics Concepts, Design and Applications “, Universities Press, 2015.

PTME7601 DESIGN OF TRANSMISSION SYSTEMS L T P C
3 0 0 3

OBJECTIVES
- To gain knowledge on the principles and procedures for the design of mechanical power transmission components.
- To understand the standard procedures available for design of transmission elements.

UNIT I DESIGN OF FLEXIBLE ELEMENTS 9
Design of Flat belts and pulleys - Selection of V belts and sheaves – Selection of wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II SPUR AND HELICAL GEARS 9
Gear materials - Design of straight tooth spur & helical gears based on speed ratios, number of teeth, Fatigue strength, Factor of safety, strength and wear considerations. Force analysis -Tooth stresses - Dynamic effects - Helical gears – Module - normal and transverse, Equivalent number of teeth - forces.

UNIT III BEVEL AND WORM GEARS 9
Straight bevel gear: Gear materials - Tooth terminology, tooth forces and stresses, equivalent number of teeth, estimation of dimensions of straight bevel gears.
Worm Gear: Gear materials - Tooth terminology, Thermal capacity, forces and stresses, efficiency, estimation of dimensions of worm gear pair.

UNIT IV GEAR BOXES 9
Need - Design of sliding and constant mesh gear boxes: Speed selection - Geometric progression - Standard step ratio - Ray diagram, kinematic layout – Determination of number of teeth. Design of multi speed gear box for machine tool applications, Variable speed gear box.

UNIT V CLUTCHES, BRAKES AND CAMS 9
Design of single and multi plate clutches, cone clutches, internal expanding rim clutches. Design of brakes: External shoe brakes - Single and Double Shoe, Internal expanding shoe brakes.
Design of Cams: Types- Pressure angle and under cutting, determination of base circle -forces and surface stresses.

TOTAL:45 PERIODS

Note: (Use of standard Design Data Book is permitted in the University examination)

OUTCOMES:

Upon completion of this course, the students will be able to:

- Appreciate the functions of various transmission elements and their assemblies
- Design different transmission components according to the requirement as per standards using data books.

TEXT BOOKS:

1. Joseph Shigley,Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 10th Edition, Tata McGraw-Hill, 2014.
2. Sundararajamoorthy T. V and Shanmugam .N, "Machine Design", 9th edition, Anuradha Publications, Chennai, 2003.

REFERENCES:

1. Bhandari V, "Design of Machine Elements", 15th Reprint, Tata McGraw-Hill Book Co, 2014.
2. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2003.
3. Md. Jalaludeen , Machine Design, Volume II, Design of Transmission Systems, 4th edition, Anuradha Publications, 2014.
4. GitinMaitra,L. Prasad "Handbook of Mechanical Design", 2nd Edition, Tata McGraw-Hill,2001.
5. C.S.Sharma, Kamlesh Purohit, "Design of Machine Elements", Prentice Hall of India,Pvt. Ltd., 2003.
6. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements",2nd Edition, Tata McGraw Hill, 2006.
7. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",5th Edition, Wiley, 2011
8. Design Data Hand Book, PSG College of Technology, 2013- Coimbatore

PTME7602 HEAT AND MASS TRANSFER L T P C
3 0 0 3

OBJECTIVES:

- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

UNIT I CONDUCTION 9

General Differential equation – Cartesian, Cylindrical and Spherical Coordinates – One Dimensional Steady State Heat Conduction –– plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite systems, Systems with finite conductive and convective resistances –Use of Heisler's charts.

UNIT II CONVECTION 9

Boundary Layer Concept – Forced Convection: External Flow – Flow over Plates, Cylinders Spheres and Bank of tubes. Internal Flow – Entrance effects. Free Convection – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

Nusselt's theory of condensation- Regimes of Pool boiling , correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors.
LMTD and NTU methods.

UNIT IV RADIATION 9

Radiation laws, Black Body and Gray body Radiation. Shape Factor. Electrical Analogy. Radiation Shields.

UNIT V MASS TRANSFER 9

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion. Convective Mass Transfer – use of Correlations.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Understand and apply different heat and mass transfer principles of different applications.

TEXT BOOKS:

1. Yunus A. Cengel, "Heat Transfer A Practical Approach" – Tata McGraw Hill, Vth Edition – 2013.
2. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2010

REFERENCES:

1. R.C. Sachdeva, "Fundamentals of Engineering Heat & Mass transfer", New Age International Publishers, 2009
2. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 7th Edition, 2014.
3. S.P. Venkateshan, "Heat Transfer", Ane Books, New Delhi, 2014.
4. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
5. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
6. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 2012
7. Yadav, R., "Heat and Mass Transfer", Central Publishing House, 2012

PTME7603	METROLOGY AND MEASUREMENTS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To expose the science behind the measurements and their applications in manufacturing industries in quality control.

UNIT I BASICS OF METROLOGY 9

Need for Metrology, Role in quality control, Factors affecting measurement - SWIPE; Errors in Measurements – Types – Control – Measurement uncertainty – Types, Estimation, Problems on Estimation of Uncertainty, Statistical analysis of measurement data, Calibration of measuring instruments, ISO standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 9

Linear Measuring Instruments – Vernier caliper, Micrometer, Vernier height gauge, Depth Micrometer, Bore gauge, Telescoping gauge; Tolerance – Interchangeability, Selective assembly, Terminology, Limits and Fits, Problems; Design of Limit gauges, Problems, Gauge blocks – Use and precautions, Comparators – Working and advantages; Toolmaker's microscope – Profile projector - Angular measuring instruments – Bevel protractor, Clinometer, Angle gauges, Precision level, Sine bar, Autocollimator, Angle dekkor, Alignment telescope.

UNIT III METROLOGY OF SURFACES 9

Fundamentals of GD & T- Measurement of straightness, flatness and roundness, Simple problems – Measurement of Surface finish – Functionality of surfaces, Parameters, Comparative, Stylus based and Optical Measurement techniques, Filters, Introduction to 3D surface metrology.

UNIT IV METROLOGY OF ASSEMBLY AND TRANSMISSION ELEMENTS 9

Measurement of Screw threads – purpose – Dimensioning – Limit gauging – Size limits – Single element measurements – Pitch Diameter, Lead, Pitch.

Measurement of Gears – purpose – Analytical measurement – Runout, Pitch variation, Tooth profile, Tooth thickness, Lead – Functional checking – Rolling gear test.

UNIT V ADVANCES IN METROLOGY 9

Lasers in metrology - Advantages of lasers – Laser scan micrometers; Laser interferometers – Applications – Straightness, Alignment; Ball bar tests, Computer Aided Metrology - Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Multisensor CMMs.

Machine Vision - Basic concepts of Machine Vision System – Elements – Applications - On-line and in-process monitoring in production - Computed tomography – White light Scanners.

TOTAL: 45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Make logical, rational and economical choice of measuring equipment / method to analyse and improve manufacturing processes.

TEXT BOOKS:

1. Dotson Connie, "Dimensional Metrology", Cengage Learning, First edition, 2012.
2. Mark Curtis, Francis T. Farago, "Handbook of Dimensional Measurement", Industrial Press, Fifth edition, 2013.

REFERENCES:

1. J.F.W. Galyer, Charles Reginald Shotbolt, "Metrology for Engineers", Cengage Learning EMEA; 5th revised edition, 1990.
2. Toru Yoshizawa, "Handbook of Optical Metrology: Principles and Applications", CRC Press, 2009.
3. James G. Bralla, "Handbook of Product Design for Manufacture", McGraw Hill Book Co., 2004.
4. S. P. Venkateshan, "Mechanical Measurements", Second edition, John Wiley & Sons, 2015.
5. Balasubramanian Muralikrishnan and Jayaraman Raja, "Computational Surface and Roundness Metrology", Springer-Verlag London Ltd., 2009.
6. Robert J. Hocken (Editor) and Paulo H. Pereira, "Coordinate Measuring Machines and Systems", Second Edition (Manufacturing Engineering and Materials Processing), 2nd Edition, CRC Press, 2011.
7. Ammar Grous, "Applied Metrology for Manufacturing Engineering", Wiley-ISTE, 2011.
8. N.V. Raghavendra and L. Krishnamurthy, Engineering Metrology and Measurements, Oxford University Press, 2013.
9. NPL Measurement good practice guides relevant to the syllabus – No. 40, No. 41, No. 42, No. 43, No. 80, No. 118, No. 130, No. 131.

PTME7611 SIMULATION AND ANALYSIS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

UNIT I SIMULATION

LIST OF EXPERIMENTS

1. MANUAL PART PROGRAMMING:
   (i) Part Programming - CNC Machining Centre
      a) Linear Cutting.
      b) Circular cutting.
      c) Cutter Radius Compensation.
      d) Canned Cycle Operations.
   (ii) Part Programming - CNC Turning Centre
      a) Straight, Taper and Radius Turning.
      b) Thread Cutting.
      c) Rough and Finish Turning Cycle.
      d) Drilling and Tapping Cycle.
2. COMPUTER AIDED PART PROGRAMMING
      e) CL Data and Post process generation using CAM packages.
      f) Application of CAPP in Machining and Turning Centre.

3. STUDY OF CNC EDM, CNC EDM WIRE-CUT AND RAPID PROTOTYPING.

UNIT II ANALYSES

LIST OF EXPERIMENTS

Use of any finite element analysis software for following problems:

1. Force and Stress analysis using link elements in Trusses, cables and bars.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of fins, plates and cylinders.
6. Vibration analysis of spring-mass systems.
7. Modal analysis of Beams.
8. Harmonic, transient and spectrum analysis of simple systems

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Understand the use of analysis and simulation software to solve problems in Mechanical Engineering.

PTME7701	MECHATRONICS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge about the elements and techniques involved in Mechatronics systems in understanding the concept of automation.

UNIT I INTRODUCTION 9

Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and Dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance Sensors – Strain Gauges – Eddy Current Sensor – Hall Effect Sensor –Temperature Sensors – Light Sensors.

UNIT II 8085 MICROPROCESSOR 9

Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, Timing diagram of 8085.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 9

Introduction – Architecture of 8255, Keyboard Interfacing, LED display – Interfacing, ADC and DAC Interface, Temperature Control – Stepper Motor Control – Traffic Control Interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 9

Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN 9

Types of Stepper and Servo motors – Construction – Working Principle – Characteristics, Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Design Mechatronics systems with the help of Microprocessor, PLC and other Electrical and Electronics Circuits.

TEXT BOOKS:

1. Bolton W., “Mechatronics”, Pearson Education, 4th Edition, 2011.
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, Penram International Publishing Private Limited, 6th Edition, 2015.

REFERENCES:

1. Smaili.A and Mrad.F, “Mechatronics Integrated Technologies for Intelligent Machines”, Oxford University Press, 2007.
2. Davis G.Alciatore and Michael B.Histand, “Introduction to Mechatronics and Measurement systems”, McGraw Hill Education, 2011.
3. Bradley D.A., Dawson D., Buru N.C. and Loader A.J., “Mechatronics”, Chapman and Hall, 1993.
4. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applications”, McGraw Hill Education, 2015.
5. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, Cengage Learning, 2010.

PTME7751 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the working of power plants and analyse their performance.
- To learn the economics of power generation.

UNIT I HYDRO POWER PLANTS 9

Energy scenario – Global and National. Essential elements and classification of hydro power plants. Typical Layout and associated components. Selection of turbines. Pumped storage plants.

UNIT II COAL, OIL AND GAS TURBINE POWER PLANTS 9

Cycle analysis - Layout of modern coal based power plant. Super Critical Boilers - FBC Boilers. Subsystems – Water and Steam, Fuel and ash handling, Air and Gas, Draught system. Diesel and Gas Turbine power plants- Layout and Functioning. Environmental impact and Control.

UNIT III NUCLEAR POWER PLANTS 9

Layout and subsystems. Fuels and Nuclear reactions. Boiling Water Reactor, Pressurized Water Reactor, Fast Breeder Reactor, Gas Cooled and Liquid Metal Cooled Reactors – working and Comparison. Safety measures. Environmental aspects.

UNIT IV RENEWABLE ENERGY POWER PLANTS 9

Solar power plants – Photovoltaic and Thermal. Wind power plants – Vertical and Horizontal axes Wind Turbines. Biomass power plants – Gasification and combustion. Tidal and Ocean Thermal Energy plants. Geothermal plants. Fuel cell – Types. Hybrid power plants.

UNIT V ECONOMICS OF POWER GENERATION 9

Load and load duration curves. Electricity billing – costing of electrical energy – Tariff structures. Economics of power plant – Fixed and variable cost. Payback period. Net Present Value, Internal Rate of Return. Emission calculation and carbon credit.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course the students will be able to:

- Understand the working of different power plants
- Arrive at cost of power generation, electricity billing and rate of return on power plant investments

TEXT BOOKS:

1. P.K.Nag, “Power Plant Engineering”, Tata McGraw Hill, 2014.
2. Paul Breeze, “Power Generation Technologies”, Elsevier Ltd., 2014.

REFERENCES:

1. Black and Veatch, “Power Plant Engineering”, Indian edition, CBS Publishers and Distributors, New Delhi, 1998.
2. M.M.El.Wakil, “Power Plant Technology”, Tata McGraw Hill, 2010.
3. K.Rajput, “Power Plant Engineering”, Laxmi Publications, 2005.
4. Janet Wood, “Nuclear Power”, The Institution of Engineering and Technology, 2007.
5. James Momoh, Smart Grids - Fundamentals of Design and analysis, Wiley Press, 2012.

PTME7711 **PROJECT WORK** **L T P C**
0 0 9 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- A project topic must be selected by the students in consultation with their guides.
- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and fabrication of a device for a specific application, a research project with a focus on an application needed by the industry/society, a computer project, a management project or a design project.
- The progress of the project is evaluated based on a minimum of three reviews.
- The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL: 135 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Take up any challenging practical problems and find solution by formulating proper methodology.

PTMF7001 **ADDITIVE MANUFACTURING TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

UNIT I INTRODUCTION **9**

Overview – Need - Development of Additive Manufacturing Technology -Principle –AM Process Chain- Classification –Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Applications- Benefits –Case studies.

UNIT II DESIGN FOR ADDITIVE MANUFACTURING **9**

Design tools: Data processing - CAD model preparation – Part orientation and support structure generation – Model slicing –Tool path generation- Design for Additive Manufacturing: Concepts and objectives- AM unique capabilities – DFAM for part quality improvement- Customised design and fabrication for medical applications.

UNIT III PHOTO POLYMERIZATION AND POWDER BED FUSION PROCESSES 9

Photo polymerization: SLA-Photo curable materials – Process - Advantages and Applications. Powder Bed Fusion: SLS-Process description – powder fusion mechanism – Process Parameters – Typical Materials and Application. Electron Beam Melting.

UNIT IV EXTRUSION BASED AND SHEET LAMINATION PROCESSES 9

Extrusion Based System: FDM-Introduction – Basic Principle – Materials – Applications and Limitations – Bioextrusion. Sheet Lamination Process: LOM- Gluing or Adhesive bonding – Thermal bonding.

UNIT V PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES 9

Droplet formation technologies – Continuous mode – Drop on Demand mode – Three Dimensional Printing – Advantages – Bioplotter - Beam Deposition Process:LENS- Process description – Material delivery – Process parameters – Materials – Benefits – Applications.

TOTAL: 45 PERIODS

OUTCOME:

- On completion of this course, students will learn about a working principle and construction of Additive Manufacturing technologies, their potential to support design and manufacturing, modern development in additive manufacturing process and case studies relevant to mass customized manufacturing.

TEXT BOOKS:

1. Ian Gibson, David W.Rosen, Brent Stucker "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing" Springer , 2010.
2. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third edition, World Scientific Publishers, 2010.

REFERENCES:

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications :A tool box for prototype development", CRC Press, 2007.
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
3. Tom Page "Design for Additive Manufacturing" LAP Lambert Academic Publishing, 2012.
4. Andreas Gebhardt "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing" Hanser Gardner Publication 2011.

PTME7001 ADVANCED INTERNAL COMBUSTION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the principles of operation of different IC Engines, combustion process and fuel injection systems.
- To provide knowledge on pollutant formation and control, suitability of alternate fuels, and recent technological advances.

UNIT I SPARK IGNITION ENGINES 9

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection -Stages of combustion – Normal and Abnormal combustion, Spark Knock, Factors affecting knock, Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbo charging.

UNIT III POLLUTANT FORMATION AND CONTROL 9

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement –Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS 9

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS 9

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles –NO_x Adsorbers - Onboard Diagnostics.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to

- Understand the combustion process, and the fuel injection techniques adopted in modern day IC engines
- Adopt potential alternative fuel systems and exposed to recent developments in engine technology.

TEXT BOOKS:

1. V. Ganesan, “Internal Combustion Engines”, V Edition, Tata McGraw Hill, 2012.
2. K.K. Ramalingam, “Internal Combustion Engine Fundamentals”, Scitech Publications, II Ed., 2011.

REFERENCES:

1. R.B. Mathur and R.P. Sharma, “Internal Combustion Engines”, Dhanpat Rai & Sons 2007.
2. B.P. Pundir, “IC Engines Combustion & Emission”, Narosa Publishing House, 2014.
3. Duffy Smith, “Auto Fuel Systems”, The Good Heart Wilcox Company, Inc., 2003.

PTME7002	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To provide a first course of teaching such that the learners are able to visualise the scope of Automobile Engineering.

UNIT I INTRODUCTON TO AUTOMOTIVES 9

An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Quality standards, Trends in automobile design.

UNIT II POWER SOURCE FEATURES 9

Reciprocating Engine systems, Rotary Engine systems, Gas Turbine systems, Hybrid systems. Pollutant emissions and their control; Catalytic converter systems, Electronic Engine Management systems.

UNIT III TRANSMISSION, SUSPENSION AND BRAKING SYSTEMS 9

Clutch system, Gear box system, propeller shafting, differential, axles, wheels and tyres and preliminaries of suspension systems.

UNIT IV AUXILIARY SYSTEMS 9

Electrical and electronic systems, safety systems, Heating, Ventilation, and Air Conditioning (HVAC) systems, Vehicle Thermal Management System and vehicle body design features.

UNIT V TESTS, SERVICE AND MAINTENANCE 9

Engine Tuning, vehicle maintenance, engine and Chassis Dynamometry Pollutants and emissions check, Wind Tunnel Tests, preliminaries of engine and vehicle testing.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Identify the different components in an automobile.
- Clearly understand different auxiliary and transmission systems.

TEXT BOOK:

1. William H. Crouse and Donald L. Anglin, “Automotive Mechanics”, Tata McGraw Hill, 2004, Tenth Edition.

REFERENCES:

1. Bosch “Automotive Handbook”, Robert Bosch GmbH, Germany, 2004, Sixth Edition.
2. Jack Erjavek, “Automotive Technology – A Systems Approach”, Thomson Learning, 3rd Edition, 1999.

PTME7003	CASTING AND WELDING PROCESSES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge on Design of Gating system for Castings, Foundry Practice of Ferrous, Non Ferrous alloys, Foundry Mechanisation, Welding Processes and Welding Metallurgy.

UNIT I DESIGN OF GATING SYSTEM 9

Gating system design - pouring time – Choke Area – Sprue – Other gating elements – Riser design - Caine's – Modulus – Naval Research Laboratory method – feeding distances – Chills feeding Aids – Design of Castings.

UNIT II FERROUS AND NON FERROUS CASTINGS 9

Steel Casting – The family of cast iron – melting of steels and cast irons – Grey iron foundry practice – Ductile iron – Malleable Iron casting design – Aluminium, Magnesium, Copper, Zinc. , Duplex Stainless Steel and Titanium alloys foundry practice.

UNIT III FOUNDRY MECHANISATION 9

Mechanical equipments in foundry – plant site location, layout – Plant Engineering –Maintenance – Services – Practical aspects.

UNIT IV WELDING PROCESS AND TECHNOLOGY 9

Friction Welding Process – effect of speed and pressure – explosive welding – plasma arc welding – Electron beam welding – High frequency induction welding - Laser beam welding.

UNIT V WELDING METALLURGY 9

Weld thermal cycles – Heat Affected Zone (HAZ) – Weldability of steels – Cast Iron – Stainless steel, aluminium – Copper and Titanium alloys – Hydrogen embrittlement – Pro and post weld heat Treatments – weld defects – Testing of Welds.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to :

- Design gating system for castings, understand the foundry practices of ferrous and non ferrous metals.
- Understand the various aspects of foundry mechanization, welding metallurgy and certain welding processes.

TEXT BOOK:

1. P.N.Rao, "Manufacturing Technology", Tata McGraw Hill, 2008.

REFERENCES:

1. Heine, Loper and Rosenthal, "Principles of Metal Casting", Tata McGraw Hill, 2001.
2. A.K.Chakrabarti, "Casting Technology and Cast Alloys", Prentice –Hall Of India Ltd, 2005.
3. T.V.Rama Rao, "Metal casting Principles and Practice", New Age International, 2010.
4. R.S Parmar, "Welding Engineering and Technology", Khanna Publishers, 2002.

PTME7004 COMPOSITE MATERIALS AND MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVES:

To understand:

- The fundamentals of composite material strength and its mechanical behavior
- Fibre reinforced Laminate design for different combinations of plies with different orientations of the fibre.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION TO COMPOSITE MATERIALS 9

Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute - Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites,

UNIT II MANUFACTURING OF COMPOSITES 9

Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state, vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation- interfaces.

UNIT III INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS 9

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Q_{ij}), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT IV LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES 9

Introduction - Maximum Stress and Strain Criteria. von-Mises Yield criterion forIsotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies.

UNIT V THERMAL ANALYSIS 9

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates.

TOTAL:45 PERIODS

OUTCOME:

- The students will be able to understand the mechanics and design related to layered components such as fiber reinforced polymer composites, isotropic layered structures (example electronic chips) etc and its manufacturing methodologies.

TEXT BOOKS:

1. Gibson, R.F., "Principles of Composite Material Mechanics", McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998.

REFERENCES:

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition – 2007.
2. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.
6. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", University Press (India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008).
7. Chung, Deborah D.L., "Composite Materials: Science and Applications", Ane Books Pvt. Ltd./Springer, New Delhi, 1st Indian Reprint, 2009.

PTME7005 COMPUTATIONAL TECHNIQUES FOR FLUID DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence in solving complex problems in the field of fluid flow and heat transfer by using high speed computers.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport –Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT IV FLOW FIELD ANALYSIS 9

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V TURBULENCE MODELS AND MESH GENERATION 9

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Create numerical models and their role in the field of fluid flow and heat transfer
- Use the various discretization methods, solution procedures and turbulence models to solve flow and heat transfer problems.

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W.,"An Introduction to Computational Fluid Dynamics": The finite volume Method, Pearson Education Ltd. Third Edition – 2014.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES:

1. John D. Anderson "Computational Fluid Dynamics - The basics with Applications", McGraw-Hill International Editions, 1995.
2. Anil W. Date, "Introduction to Computational Fluid Dynamics", Cambridge University Press, Reprinted 2010.
3. Yogesh Jaluria & Kenneth E. Torrance, "Computational Heat Transfer", CRC press, 2nd Edition, 2002.
4. John. F. Wendt, "Computational Fluid Dynamics – An Introduction", Springer, Third Edition, 2013.
5. Suhas V, Patankar, "Numerical Heat transfer and Fluid flow", Taylor & Francis, 2009.

PTME7006	DESIGN FOR MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the design constraints in manufacturing and assembly operations.

UNIT I INTRODUCTION AND CASTING 9

Introduction - Economics of process selection - General design principles for manufacturability; Design considerations for: Sand cast – Die cast – Permanent mold cast parts.

UNIT II FORMING 9

Design considerations for: Metal extruded parts – Impact/Cold extruded parts – Stamped parts – Forged parts.

UNIT III WELDING 9

Arc welding – Design considerations for: Cost reduction – Minimizing distortion – Weld strength – Weldment & heat treatment. Resistance welding – Design considerations for: Spot – Seam – Projection – Flash & Upset weldment.

UNIT IV MACHINING 9

Design considerations for: Turned parts – Drilled parts – Milled, planed, shaped and slotted parts– Ground parts.

UNIT V ASSEMBLY 9

Design for assembly – General assembly recommendations – Minimizing the no. of parts – Design considerations for: Rivets – Screw fasteners – Gasket & Seals – Press fits – Snap fits – Automatic assembly.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Gain technical competency in design modification of components / products with respect to manufacturability.

TEXT BOOK:

1. James G. Bralla, “Handbook of Product Design for Manufacture”, McGraw Hill Book Co., 2004.

REFERENCES:

1. Boothroyd, G., Dewhurst, P., & Knight, A. W., “Product Design for Manufacture and Assembly”, 3rd Edition, CRC Press – Taylor Francis Group, 2011.
2. Harry Peck, “Designing for Manufacture”, Sir Isaac Pitman & Sons Ltd., 1973.

PTME7007	DESIGN OF HEAT EXCHANGERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn thermal and stress analysis on various parts of the heat exchangers
- To analyze the sizing and rating of the heat exchangers for various applications.

UNIT I INTRODUCTION 9

Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA).

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS 9

Heat transfer correlations, Overall heat transfer coefficient, analysis of heat exchangers – LMTD and effectiveness method. Sizing of finned tube heat exchangers, U tube heat exchangers, Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III STRESS ANALYSIS 9

Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER 9

Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V CONDENSERS AND COOLING TOWERS 9

Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Apply the mathematical knowledge for thermal and stress analysis of various parts of the heat exchangers components.

TEXT BOOKS:

1. Sadik Kakac, Hongtan Liu, Anchasa Pramuanjaroenkij, “Heat Exchangers Selection, Rating and Thermal Design”, CRC Press, Third Edition, 2012.
2. Shah, R. K., Dušan P. Sekulić,” Fundamentals of heat exchanger design”, John Wiley & Sons, 2003.

REFERENCES:

1. Robert W. Serth, “Process heat transfer principles and applications”, Academic press, Elesevier, 2010.
2. Sarit Kumar Das,” Process heat transfer”, Alpha Science International, 2005.
3. John E. Hesselgreaves, “Compact heat exchangers: selection, design, and operation”, Elsevier science Ltd, 2001.
4. T. Kuppan, “Heat exchanger design hand book”, New York: Marcel Dekker, 2009.
5. Eric M. Smith, “Advances in thermal design of heat exchangers: a numerical approach: direct-sizing, step-wise rating, and transients”, John Wiley & Sons, 1999.
6. Arthur. P Frass, “Heat Exchanger Design”, John Wiley & Sons, 1989.
7. G.F. Hewitt, G. L. Shires, T. R. Bott, “Process Heat transfer”, CRC Press, 1993.

PTME7008 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the importance, functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of standard views of the final design.

UNIT I PRINCIPLES OF JIGS, FIXTURES AND PRESS WORKING 9

Objectives and importance of tool design—work holding devices- Basic elements of jigs and fixtures- location – clamping-indexing-operational chart-Fits and Tolerances

Tools for press working- Press Working Terminologies –cutting and non cutting operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure– knockouts – direct and indirect – pressure pads – Ejectors- Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts –Recent trends in tooling- recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies-Poka Yoke.

UNIT II JIGS 9

Design and development of jigs for given component - Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs.

UNIT III FIXTURES 9

Design and development of fixtures for given component- General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT IV DESIGN OF CUTTING DIES 9

Complete design and preparation of standard views of simple blanking, piercing, compound and progressive dies -fine Blanking dies.

UNIT V DESIGN OF BENDING, FORMING, DRAWING AND MISCELLANEOUS DIES 9

Difference between bending forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back– Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

TOTAL:45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

OUTCOMES:

Upon completion of this course, the students will be able to:

- Design jigs, fixtures and press tools and give the assembly drawing with dimensions and Parts list.
- Use the above knowledge to design various types of dies and give the standard dimensioned views

TEXT BOOKS:

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
2. Joshi P.H “Press tools - Design and Construction”, S. Chand & Co Ltd2001.

REFERENCES:

1. K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Anne Publications, 2015.
2. Donaldson, Lecain and Goold “Tool Design”, III rd Edition Tata McGraw Hill, 2000.
3. Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton – Third Edition 1974.
4. Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2004.
5. “ASTME – Fundamentals of tool design”- Prentice Hall of India pvt. Ltd New Delhi 1984.
6. “Design Data Hand Book”, PSG College of Technology, 2013, Coimbatore.
7. V.Balachandran, “Design of Jigs Fixtures & Press Tools”, Notion Press, 2015.

PTME7009 DESIGN OF PRESSURE VESSELS AND PIPING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To apply the Mathematical knowledge gained in the design of pressure vessels and piping
- To carry out the stress analysis in pressure vessels and piping.

UNIT I INTRODUCTION **9**

Methods for determining stresses – Terminology and Ligament Efficiency – Applications.

UNIT II STRESSES IN PRESSURE VESSELS **9**

Introduction – Stresses in a circular ring, cylinder –Dilation of pressure vessels, Membrane stress Analysis of Vessel – Cylindrical, spherical and, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

UNIT III DESIGN OF VESSELS **9**

Design of Tall cylindrical self supporting process columns – Supports for short vertical vessels – Stress concentration at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – Pressure Vessel Design.

UNIT IV BUCKLING AND FRACTURE ANALYSIS IN VESSELS **9**

Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V PIPING **9**

Introduction – Flow diagram – piping layout and piping stress Analysis.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Apply the mathematical fundamentals for the design of pressure vessels and pipes.
- Analyse and design pressure vessels and piping.

TEXT BOOK:

1. John F. Harvey, “Theory and Design of Pressure Vessels”, CBS Publishers and Distributors, 1987.

REFERENCES:

1. Henry H. Bedner, “Pressure Vessels, Design Hand Book”, CBS publishers and Distributors, 1987.
2. Stanley, M. Wales, “Chemical process equipment, selection and Design. Buterworths series in Chemical Engineering”, 1988.
3. William. J., Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and Piping”, Pre ASME Pressure Vessels and Piping Conference, 1997.
4. Sam Kannapan, “Introduction to Pipe Stress Analysis”. John Wiley and Sons, 1985.

PTGE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as
- mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,
- Disaster damage assessment and management.

TEXT BOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13:978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTME7010 ENERGY CONSERVATION IN INDUSTRIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand and analyse the energy data of industries.
- To carryout energy accounting and balancing.
- To conduct energy audit and suggest methodologies for energy savings.
- To utilise the available resources in optimal ways.

UNIT I INTRODUCTION **9**

Energy - Power – Present scenario of World / Nation: Environmental aspects of Energy Generation – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Basic instruments for Energy Auditing.

UNIT II ECONOMICS **9**

Energy / Cost index diagram – Energy Economics – Cost of production – Economic evaluation techniques – Return on investment, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept

UNIT III ELECTRICAL SYSTEMS 9

TANGEDCO Billing – HT and LT supply - Transformers - Efficiency - Power Factor - Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT IV THERMAL SYSTEMS 9

Stoichiometry, Combustion principles, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency Computation and Encon Measures - Steam Traps - Cogeneration - Waste heat recovery devices.

UNIT V ENERGY CONSERVATION IN MAJOR UTILITIES 9

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems - Cooling Towers – D.G. sets

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Analyse the energy data of industries.
- Carry out energy accounting and balancing.
- Suggest methodologies for energy savings.

TEXT BOOK:

1. Guide book for National Certification Examination for “Energy Managers and Energy Auditors” (4 Volumes). Available at www.beeindia.in

REFERENCES:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” HemispherePubl, Washington, 1988.
2. Guide book for National Certification Examination for” Energy Managers and Energy Auditors” (4 Volumes). Available at www.beeindia.in
3. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
4. I.G.C. Dryden, “The Efficient Use of Energy” Butterworths, London, 1982
5. W.C. Turner, “Energy Management Hand book” Wiley, New York, 1982.
6. W.R. Murphy and G. Mc KAY “Energy Management” Butterworths, London 1987.

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES L T P C

3 0 0 3

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES 3

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics –Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY 12

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and chernobyl as case studies.

UNIT V GLOBAL ISSUES 12

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership- Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES

- Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics –Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000
5. R.Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

PTME7011	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The students will be provided with an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth – Economic, Non Economic, Government Actions.

UNIT II MOTIVATION 9

Entrepreneurial Motivation: Theories and Factors, Achievement Motivation –Entrepreneurial Competencies – Entrepreneurship Development Programs – Need, Objectives – Business Game, Thematic Apperception Test, Self Rating, Stress management.

UNIT III BUSINESS 9

Small Enterprises – Definition, Characteristics, Project Identification and selection – Project Formulation: Significance, content, formulation of project report – Project Appraisal: Concept and method – Ownership Structures: Selection & Pattern.

UNIT IV FINANCING AND ACCOUNTING 9

Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management: Significance, Assessment, Factors, Sources, Management.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business: Concept, Signals, Symptoms, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises: Growth Policy, Support. Institutional Support to Entrepreneurs: Need and Support – Taxation Benefits to Small Scale Industry: Need, Depreciation, Rehabilitation, Investment.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of the course, the students will be able to:

- Gain knowledge and skills needed to run a business successfully.

TEXT BOOKS:

1. S.S.Khanka, “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi,1999.
2. Kurahko & Hodgetts, “ Entrepreneurship – Theory, process and practices”, Thomson learning 6th edition.

REFERENCES:

1. Hisrich R D and Peters M P, “Entrepreneurship” 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala,” Entrepreneurship theory at cross roads: paradigms and praxis” Dream tech, 2nd edition 2006.
3. Rabindra N. Kanungo, “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C
3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES:

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PTME7012 GAS DYNAMICS AND SPACE PROPULSION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of compressible flow in constant and variable area ducts.
- To understand the behaviour of shock waves and its effect on flow.
- To gain basic knowledge about Jet and Rocket propulsion.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9

Energy and momentum equations of compressible fluid flows, Concepts of compressible flow – Mach waves and Mach cone. Flow regimes, effect of Mach number on compressibility. Stagnation, static, critical properties and their interrelationship. Isentropic flow and its relations. Isentropic flow through variable area ducts – nozzles and diffusers. Use of Gas tables.

UNIT II FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties. Choking concept, Isothermal flow with friction. Use of Gas tables.

UNIT III NORMAL AND OBLIQUE SHOCKS 9

Governing equations - Rankine-Hugoniot Relation. Variation of flow parameters across the normal and oblique shocks. Prandtl – Meyer expansion and relation. Use of Gas tables.

UNIT IV JET PROPULSION 9

Theory of jet propulsion – thrust equation – Performance parameters - thrust, power and efficiency. Operation, cycle analysis and performance of ram jet, turbojet, turbofan, turbo prop and pulse jet engines.

UNIT V SPACE PROPULSION 9

Types of rocket engines and propellants. Characteristic velocity – thrust equation. Theory of single and multistage rocket propulsion. Liquid fuel feeding systems. Solid propellant geometries. Orbital and escape velocity. Rocket engine performance parameters and problems.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Apply the principles of gas dynamics in Jet and Space Propulsion.

TEXT BOOKS:

1. Anderson, J.D.," Modern Compressible flow", 3rd Edition, McGraw Hill, 2003.
2. Yahya, S.M., "Fundamentals of Compressible Flow with Aircraft and Rocket propulsion", New Age International (P) Limited, 4th Edition, 2012.

REFERENCES:

1. Zucker, R.D., and Biblarz, O., "Fundamentals of Gas Dynamics", 2nd edition, Wiley, 2011.
2. Sutton, G.P. "Rocket Propulsion Elements", John Wiley, 8th edition 2010, New York.
3. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2006.
4. Shapiro, A.H.," The Dynamics and Thermodynamics of Compressible Fluid Flow, Vol. 1", John Wiley, 1953.
5. Balachandran, P., "Fundamentals of Compressible Fluid Dynamics", Prentice Hall of India, 2007
6. Hill and Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley, 1965.
7. Zucrow, N.J., "Aircraft and Missile Propulsion, Vol.1 & II", John Wiley, 1975.

PTGE7073	HUMAN RIGHTS	L T P C
		3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PTME7013 INTRODUCTION TO OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the concepts in optimization of resources for manufacturing and service based industries.

UNIT I LINEAR PROGRAMMING PROBLEMS **9**

OR-Definition - Phases - models, LP problems formulation – Graphical solution, GLPP, Standard and Canonical forms of LPP- simplex methods- Big M, Two phase methods, Alternate optimal solutions, Duality in LP.

UNIT II TRANSPORTATION **9**

Transportation problems- Basic feasible solution, Optimal solution By MODI method, Balanced and Unbalanced TP, Degeneracy, Production problems. Assignment problems – Hungarian method Traveling salesman problems - Sequencing models- Johnson algorithm, n job 2 machines, n job 3 machines and n job m machines.

UNIT III INVENTORY CONTROL **9**

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Purchase and Production models with and without shortages-EOQ with price breaks - Stochastic inventory problems - Multi product problems - Systems of inventory control (P and Q Systems)- Determination of buffer stock and re-order levels -Selective inventory control techniques (ABC, VED, SDE, etc.)

UNIT IV QUEUING THEORY **9**

Queuing system - Characteristics - symbols - Poisson process and exponential distribution -Single server queuing models - Multiserver queuing models, Simulation Monte Carlo technique- Inventory & Queuing problems.

UNIT V PROJECT MANAGEMENT AND REPLACEMENT MODELS **9**

Project management: Network logic – Ford-Fulkerson's rule - AON diagram - CPM and PERT techniques, Critical path and float calculations Replacement models -types of failures – Gradual failures-replacement of items: Efficiency deteriorates with time, sudden failures- individual and group replacement policies.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Understand and apply the operations research techniques in industrial operations.

TEXT BOOKS:

1. Wayne.L.Winston, “Operations research applications and algorithms”, 4th edition, 2007,Thomson learning.
2. Hamdy ATaha, “Operations research an introduction”, 9th edition 2011, PHI/Pearson education.

REFERENCES:
1. G.Srinivasan, “Operations research principles and applications”, 2nd edition EEE 2010, PHI.
2. R.Pannerselvam, “Operations research”, 2nd edition 2009, PHI
3. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations research concepts and cases”, 8th edition (SIE) 2008,TMH.
4. Ravindran, Phillips and Solberg, “Operations research principles and practice”, 2nd edition 2007, Wiley India.
5. J.K.Sharma, “Operations research theory and applications”,5Th edition 2013, Macmillan India.
6. Prem kumar Gupta and D.S.Hira, “Problems in Operations research”,2009 S.Chand.

PTGE7075 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS:

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTME7014	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To expose the students to newer concepts of marketing principles like strategic marketing concepts, segmentation, pricing, advertisement and strategic formulation.

UNIT I CONCEPTS IN MARKETING 9

Definition, Marketing Process, Dynamics, Needs, Wants and Demands, Marketing Concepts, Environment, Mix, Types, Philosophies, Selling vs Marketing, Consumer Goods, Industrial Goods.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, Demographic factors, Motives, Types, Buying Decisions, Segmentation factors, Demographic, Psycho graphic and Geographic Segmentation, Process, Patterns. Services marketing and Industrial marketing.

UNIT III PRODUCT, PRICE AND MARKETING RESEARCH 9

Product, Classifications of product, Product Hierarchy, Product Life Cycle, New product development, Branding.

Price: Objectives, Pricing Decisions and Pricing Methods, Pricing Management, Introduction, Uses, Process of Marketing Research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of a Marketing Plan, Strategy Formulation and the Marketing Process, Implementation, Portfolio Analysis, BCG, GEC Grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Advertising-Characteristics, Impact, Goals, Types, Sales Promotion – Point of purchase, Unique Selling Propositions, Characteristics, Wholesaling, Retailing, Channel Design, Logistics, Modern Trends in Retailing, Modern Trends, e-Marketing.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Understand the philosophies of marketing and should able to formulate market planning, strategies and could promote sales in effective manner**.**

TEXT BOOKS:

1. Govindarajan. M, “Marketing management – concepts, cases, challenges and trends”, Prentice hall of India, second edition, 2007.
2. Philip Kolter & Keller, “Marketing Management”, Prentice Hall of India, XII edition, 2006.

REFERENCES:

1. Donald S. Tull and Hawkins, “Marketing Research”, Prentice Hall of Inida-1997.
2. Philip Kotler and Gary Armstrong “Principles of Marketing” Prentice Hall of India, XII Edn, 2000.
3. Ramasamy and Nama kumari, “Marketing Management**:** Planning, Implementation and Control, Macmillan and Company,”, 2002
4. Czinkota&Kotabe, “Marketing management”, Thomson learning, Indian edition 2007
5. Adrain palmer, “Introduction to marketing theory and practice”, Oxford university press IE 2004.

PTPH7152	**MATERIALS SCIENCE**	**L T P C**
	(Common to Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering)	**3 0 0 3**

OBJECTIVE:

- To introduce the essential principles of materials science for mechanical and related Engineering applications.

UNIT I PHASE DIAGRAMS 9

Solid solutions - Hume Rothery's rules - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II FERROUS ALLOYS AND HEAT TREATMENT 9

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructue of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, baintic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

UNIT III MECHANICAL PROPERTIES 9

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS 9

Ferromagnetism – Domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites - dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials, properties, types and applications.

UNIT V NEW MATERIALS 9

Ceramics – types and applications – Composites: classification, role of matrix and reinforcement – processing of fiber reinforced plastics – Metallic glasses – types , glass forming ability of alloys – Inoue criteria – melt spinning process – applications - Shape memory alloys – phases, shape memory effect, pseudoelastic effect – NiTi alloy – applications- Nanomaterials – preparation: ball milling and chemical vapour deposition - properties and applications – carbon nanotubes - Biomaterials

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to apply the different materials, their processing, and heat treatments in suitable application in mechanical engineering fields.

TEXT BOOKS:

1. Raghavan, V. “Physical Metallurgy: Principles and Practice”, Phi Learning (2009).
2. Balasubramaniam, R. “Callister's Materials Science and Engineering”, Wiley India Pvt. Ltd. (2014).
3. Palanisamy P.K., “Materials Science” , Scitech (2013).

REFERENCES:

1. Raghavan, V. “Materials Science and Engineering”, Printice Hall of India (2007).
2. Shackelford, J.F. “Introduction to Materials Science for Engineers”. Pearson India (2006).
3. Donald Askeland. “Materials Science and Engineering”, Brooks/Cole (2010).
4. Smith, W.F., Hashemi, J. and R.Prakash. “Materials Science and Engineering”,Tata Mcgraw Hill Education Private Limited (2014).

PTME7015 MECHANICAL VIBRATION AND NOISE CONTROL L T P C
3 0 0 3

OBJECTIVES:

- To understand the sources of vibration and noise in various systems.
- To apply the various control techniques to reduce the vibration and noise and improve the life of the components.

UNIT I BASICS OF VIBRATION 9

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II BASICS OF NOISE 9

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES 9

Noise - Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine necessary contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9

Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCES OF NOISE AND ITS CONTROL 9

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Appreciate the need and its relevance for vibration and noise studies
- Gain knowledge on measurement of vibration and noise levels in machineries and its components.
- Expose themselves to various control measures of both vibration and noise in different industrial applications.

TEXT BOOKS:

1. Singiresu S.Rao - “Mechanical Vibrations”, 5th Edition, Pearson Education, 2010
2. Grover. G.T., “Mechanical Vibrations”, Nem Chand and Bros., 2009.

REFERENCES:

1. Benson H. Tongue, “Principles of Vibrations”, 2nd Edition, Oxford University, 2007.
2. David Bies and Colin Hansen, “Engineering Noise Control – Theory and Practice”, 4th Edition CRC Press; 4 edition (24 June 2009).
3. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, “Theory of Vibration with Application”, 5th edition Pearson Education, 2011.

4. Bernard Challen and Rodica Baranescu - “Diesel Engine Reference Book” – Second Edition - Butterworth-Heinemann Ltd; 2 edition May 1999.
5. Julian Happian-Smith - “An Introduction to Modern Vehicle Design”- Butterworth- Heinemann, ISBN 0750-5044-3 – 2004.
6. Rao, J.S and Gupta, K., “Introductory course on Theory and Practice of Mechanical Vibration”, Reprint, New Age International Publications, 2014.
7. A.A. Shabana, “Theory of vibrations – An introduction”, 3rd Edition, Springer, 2010.
8. BalakumarBalachandran and Edward B. Magrab, “Fundamentals of Vibrations”, 1st Editon, Cengage Learning, 2009.
9. John Fenton, “Handbook of Automotive body Construction and Design Analysis “– Professional Engineering Publishing, ISBN 1-86058-073- 1998.

PTME7016 MEMS AND MICROSYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic engineering concepts of MEMS.
- To gain knowledge about the various Micromanufacturing Techniques.
- To comprehend the working principle of Microsensors and Actuators.
- To realize the concepts of Microfluidics and the applications of MEMS.

UNIT I BASIC ENGINEERING FOR MEMS 9

History of MEMS Development, Multidisciplinary Nature of Microsystems, Energy Domains, Scalling Laws in Miniaturaization, Essential Electrical and Mechanical Concepts in MEMS, Materials for MEMS and Microsystems.

UNIT II MICROMANUFACTURING TECHNIQUES 9

Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour Deposition-Sputtering, Deposition by Epitaxy, Etching, Bulk Micromanufacturing, Micromachining Processes, LIGA Process, Microsystem Assembly and Testing.

UNIT III ELECTROSTATIC AND THERMAL BASED MEMS 9

Introduction to Electrostatic Sensors and Actuators, Parallel-Plate Capacitor, Application of Parallel-Plate Capacitors, Interdigitated Finger Capacitors, Applications of Comb-Drive Devices, Introduction to Thermal Sensors and Actuators, Sensors and Actuators Based on Thermal Expansion, Thermocouples, Thermal Resistors, Shape Memory Alloy, Applications of Thermal Sensors and Actuators.

UNIT IV PIEZO / RESISTIVE / ELECTRIC AND MAGNETIC BASED MEMS 9

Introduction to Piezoresistive & Piezoelectric effects, Piezoresistive & Piezoelectric materials, Stress Analysis of Mechanical Elements, Applications of Piezoresistive & Piezoelectric Sensors and Actuators, Essential Concepts and Principles of Magnetic Sensors and Actuators, Fabrication of Micro Magnetic Components, Applications of Magnetic Sensors and Actuators.

UNIT V MICROFLUIDICS AND APPLICATIONS OF MEMS 9

Microfluidics - Fluid Mechanics Concepts, Design and Fabrication of Channels, Valves, Pumps, Case Studies - Accelerometer, Gyros, RF MEMS and MOEMS.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Understand the working principle of MEMS and methods of manufacturing Microsystems.
- Select suitable microsystems for Industrial applications.

TEXT BOOKS:

1. Chang Liu, “Foundations of MEMS”, Pearson Education, 2012.
2. Tai-Ran Hsu, “MEMS and Micro systems Design and Manufacture”, McGraw Hill Education, 2015.

REFERENCES:

1. Stephen D Senturia, “Microsystem Design”, Kluwer Academic Publishers, 2002.
2. Marc Madou, “Fundamentals of Microfabrication”, CRC Press, 2002.
3. Nitaigour Premchand Mahalik, “MEMS”, McGraw Hill Education, 2014.

PTME7017 NEW AND RENEWABLE SOURCES OF ENERGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To instruct the importance of renewable energy sources and its utilization.
- To educate the various renewable energy technologies.

UNIT I SOLAR ENERGY **9**

Present renewable energy status in India - Solar radiation – Measurements of solar radiation and sunshine – Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT II WIND ENERGY **9**

Wind data and energy estimation – Betz limit - Site selection for windfarms – Horizontal axis wind turbine – Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

UNIT III BIO - ENERGY **9**

Bio resources – Biomass direct combustion – Biomass gasifier - Types of biomass gasifiers - 4Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

UNIT IV OCEAN AND GEOTHERMAL ENERGY **9**

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.

UNIT V NEW ENERGY SOURCES **9**

Fuel cell – Principle - Types of fuel cells – Hydrogen energy – Properties – Hydrogen production – Storage – Transport and utilisation - Safety issues.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Know the importance of renewable energy sources utilization and various renewable energy technologies.

TEXT BOOKS:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
2. Twidell, J.W. & Weir, A., “Renewable Energy Resources”, EFN Spon Ltd., UK, 2005.

REFERENCES:

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
2. S.P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
3. G.N. Tiwari, “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science Intl Ltd, 2015.
4. B.H. Khan, “Non-Conventional Energy Resources”, The McGraw Hill companies, 2009

PTME7018	NONDESTRUCTIVE MATERIALS EVALUATION	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge on various Non-Destructive Evaluation and Testing methods, Interpretation of results, theory and their industrial applications.

UNIT I INTRODUCTION AND VISUAL INSPECTION METHODS 9

NDT versus Mechanical testing, Need for NDT, Relative merits and limitations, various physical characteristics of materials and their applications in NDT.

Visual Inspection -Unaided, Aided- Borescopes -Videoscopes, Special features in Borescopes, Selection of borescopes, Optical sensors, Microscopes & replication Microscopy Technique and applications.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING 9

LPT - Principle, types, Procedures, Penetrants and their characteristics, Emulsifiers, Solvent Cleaners / Removers, Developers- properties and their forms, Equipments, Advantages and limitations, Inspection and Interpretation, Applications.

MPT-Principle, Theory of Magnetism, Magnetising current, Magnetisation methods, Magnetic particles, Procedure, Interpretation, Relevant and Non-relevant indications, Residual magnetism, Demagnetisation – need, methods,Advantages and Limitations, Applications, Magnetic Rubber Inspection, Magnetic Printing, Magnetic Painting.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING 9

Thermography – Introduction, Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages &limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods and applications.

Eddy current Testing – Principle, properties of eddy currents, Eddy current sensing elements, probes, Instrumentation, Types of arrangement, Advantages & Limitations, Interpretation of Results & applications.

UNIT IV ULTRASONIC TESTING AND ACOUSTIC EMISSION TESTING 9

Ultrasonic Testing-Principle, Basic Equipment, Transducers, couplants, Ultrasonic wave, Variables in UT, Transmission and Pulse-echo method, Straight beam and angle beam, A-Scan, B-Scan & C-Scan, Phased Array Ultrasound & Time of Flight Diffraction, Advantages & Limitations, Interpretation of Results & Applications.

Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages & Limitations, Interpretation of Results, Applications.

UNIT V RADIOGRAPHY 9

Introduction, Principle, X-ray Production, Gamma ray sources, tubing materials, Xray tubing characteristics, Interaction of X-ray with matter, Imaging, Film techniques, Filmless techniques, Types and uses of filters and screens, Real time radiography, geometric factors, inverse square law, characteristics of film, graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Digital Radiography – Film Digitisation, Direct Radiography & Computed Radiography, Computed Tomography, Gamma ray Radiography, Safety in X- ray and Gamma Rray radiography.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Evaluate and interpret components / products through NDT either as Quality Assurance Team Member or Production Team Member.

TEXT BOOKS:

1. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, “Introduction to nondestructive testing: a training guide”, Wiley, 2nd edition New Jersey, 2005

REFERENCES:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash, “Non-Destructive Testing Techniques”, New Age International Publishers, 1st revised edition, 2010
3. Charles, J. Hellier,“ Handbook of nondestructive evaluation”, McGraw Hill, New York 2001.
4. G. Gaussorgues, “Infrared Thermography”, Chapman & Hall, University Press, Cambridge, 1994.
5. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, AcousticEmission Testing, Vol. 7, Ultrasonic Testing.

PTMF7002 NON-TRADITIONAL MACHINING PROCESSES L T P C
3 0 0 3

OBJECTIVES:

At the end of this course the students are expected to

- Understand the working principles of various non-traditional machining processes, their applications, advantages and limitations.
- The students can also able to learn advanced nano finishing processes, recent developments in the non-traditional machining processes and to compare them.

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Introduction to non-traditional machining processes, need for non-traditional machining, classification of non-traditional machining processes, their applications, advantages, limitations. Abrasive jet machining, abrasive water jet machining, ultrasonic machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining, electro-chemical machining, electro-chemical honing, electro-chemical grinding, electro-chemical deburring their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT III THERMO-ELECTRIC ENERGY BASED PROCESSES 9

Electric discharge machining, wire electric discharge machining, laser beam machining, plasma arc machining, electron beam machining, Ion beam machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT IV ADVANCED NANO FINISHING PROCESSES 9

Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9

Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are expected to understand

- The working principles of various non-traditional machining processes, their applications, advantages and limitations.
- Advanced nano finishing processes.
- Recent developments in the non-traditional machining processes.
- Comparison of non-traditional machining processes.

TEXT BOOKS:

1. M. Adithan, “Unconventional Machining Processes”, Atlantic, New Delhi, 2009.
2. V. K. Jain, “Introduction to Micromachining”, Narosa publishing House, New Delhi, 2014.

REFERENCES:
1. V. K. Jain, “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., New Delhi, 2002.
2. Serope Kalpakjian and Steven R. Schmid, “Manufacturing Engineering and Technology”, Prentice Hall, 2013.
3. Serope Kalpakjian and Stevan R. Schemid, “Manufacturing Processes for Engineering Materials”, Pearson Education, 2008.
4. Brahem T. Smith, “Advanced machining”, I.F.S., U.K, 1989.
5. Benedict, G.F., “Non-traditional Manufacturing Processes”, Marcel Dekker Inc., New York 1987.
6. Pandey P.C. and Shan H.S., “Modern Machining Processes”, Tata McGraw Hill, New Delhi,1980.
7. Metals Handbook, Vol. 3, Machining, American Society for Metals, Metals Park, USA.

PTMA7071 PROBABILITY AND STATISTICS L T P C
3 0 0 3

OBJECTIVES :
- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES 9

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 9

Sampling distributions - Tests for single mean, proportion, difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT IV DESIGN OF EXPERIMENTS 9

Completely randomized design – Randomized block design – Latin square design - 2^2 - Factorial design - Taguchi’s robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 9

Control charts for measurements ($\overline{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 45 PERIODS

OUT COMES :

- Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions.
- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

TEXT BOOKS :

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2011.

REFERENCES :

1. Devore. J.L., " Probability and Statistics for Engineering and the Sciences ", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 3rd Edition, 2004.
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, New Delhi, 2004.
5. Papoulis. A and Unnikrishnapillai. S., " Probability, Random Variables and Stochastic Processes ", McGraw Hill Education India , 4th Edition , New Delhi , 2010.

PTME7019	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To give an understanding of the fundamentals of Process Planning and estimation of appropriate costs of processes and products and applying these to manage competitive manufacturing systems and organisations.

UNIT I INTRODUCTION TO PROCESS PLANNING 9

Aims and Objectives, Place of process planning in Manufacturing cycle, Drawing interpretation, Dimensional tolerance vs Production processes.

UNIT II PROCESS PLANNING STEPS 9

Design of a process plan – Selection of production processes, tools and process parameters-Positioning and work holding devices, Selection of inspection devices and tools, Documenting the process plan, Simple Case studies.

Computer-Aided Process Planning (CAPP) – Benefits, Architecture and approaches.

UNIT III INTRODUCTION TO COST ESTIMATION 9

Importance, Types, Purpose, Components, Procedure, Classification of costs, Cost elements, Overhead expenses, Break-even analysis.

UNIT IV PRODUCTION COST ESTIMATION 9

Estimation of production cost for - Casting processes, Welding processes, and Forging processes.

UNIT V ESTIMATION OF MACHINING TIME AND COST 9

Estimation of Machining time – Lathe operations, Drilling, Milling, Shaping and Planing, and Grinding, Cost estimation for machining processes.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Make logical, rational and economical process plans and realistic cost estimates of Components and Products.

TEXT BOOKS:

1. Gideon Halevi, "Process and operation planning", Kluwer academic publishers (Printed ebook), 2003.
2. M. Adithan," Process Planning and Cost Estimation", New Age International Publishers, 2007.

REFERENCES:

1. Peter Scallan, "Process planning, The Design/Manufacture interface", Butterworth-Heinemann, 2003.
2. Robert Creese, M. Adithan, B.S Pabla, "Estimating and Costing for the Metal Manufacturing Industries", Marcel Dekker, 1992.
3. Phillip F. Ostwald, Jairo Munoz, "Manufacturing Processes And Systems", 9th Edition, Wiley student edition, 2002.
4. Chitale, A, K., and Gupta, R. C,, "Product Design and manufacturing", Prentice Hall of India, New Delhi , 1997.
5. G.B.S. Narang, V. Kumar, "Production and Costing", Khanna Publishers, 2000.

PTME7020 PRODUCT DESIGN AND DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic concepts of Product Design and Process Development.
- To appreciate the importance, various stages, concepts, management and prototyping of products.

UNIT I INTRODUCTION 9

Introduction – Characteristics of Successful Product Development – Duration and cost of Product Development – Challenges – Generic Development Process – Concept Development: the Front End Process – Adaptation of the Generic Product Development Process – Product Development Process Flow – Product Development Organization.

UNIT II PRODUCT PLANNING, IDENTIFYING CUSTOMER NEEDS, PRODUCT SPECIFICATION 9

Product Planning Process: Identification of opportunities; evaluation and prioritization of projects; allocation of resources & plan timing; completion of pre-project planning. Identification of Customer Needs: Collection of raw data from customers; interpretation of raw data of customer needs; organization of the needs into a hierarchy; establishment of relative importance of needs. Product Specifications: Establishment of Target Specifications, Setting-up of Final Specifications.

UNIT III CONCEPT GENERATION, SELECTION, TESTING 9

Concept Generation: clarification of the problem; searching externally; searching internally, systematic exploration. Concept Selection: concept screening steps; concept scoring steps. Concept Testing: Defining the purpose of concept test; choosing a survey population; format; communicating the concept; measuring the customer response; interpretation of results.

UNIT IV PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN, DESIGN FOR MANUFACTURE 9

Product Architecture: Types of modularity – Implications – Establishing the Architecture – Platform Planning. Industrial Design: Assessing the need – Impact – Design Process. Design for Manufacturing: estimation of manufacturing costs; reduction of costs of components, assembly, supporting production; other factors.

UNIT V PROTOTYPING AND MANAGING PRODUCTS 9

Prototype Basics – Principles of Prototyping – Prototyping Technologies – Planning for Prototypes. Management of Projects: Understanding and representing Tasks – Baseline Project Planning – Accelerating Projects – Project Execution – Postmortem Project Evaluation.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Launch own ideas and the ideas of others, which would enable them to manage to work with innovation and development in large companies
- Apply new theories on innovation and change, including emerging paradigms such as user-driven innovation, open innovation and market forecasting in practice.

TEXT BOOK:

1. Ulrich K.T. and Eppinger S.D., “Product Design and Development” McGraw-Hill Education; 5 edition, 2011.

REFERENCES:

1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Rosenthal S., “Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Pugh S., “Total Design – Integrated Methods for Successful Product Engineering”, Addison Wesley Publishing, 1991, ISBN 0-202-41639-5.

PTME7021 REFRIGERATION AND AIR - CONDITIONING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the principle of operation and design aspects of Refrigeration & Air conditioning systems and components.

UNIT I VAPOUR COMPRESSION REFRIGERATION SYSTEM 9

Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle - sub-cooling and super heating- effects of condenser and evaporator pressure on COP- multi-pressure system - low temperature refrigeration - Cascade systems – problems.

UNIT II REFRIGERANTS AND COMPONENTS OF REFRIGERATION SYSTEMS 9

Refrigerants desirable properties – Classification - Nomenclature - ODP & GWP; Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III OTHER REFRIGERATION SYSTEMS 9

Working principles of Vapour absorption systems and adsorption cooling systems - Steam jet refrigeration- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES 9

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychrometry of air-conditioning processes, mixing of air stream.

UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION 9

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system. Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls, Filters.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Appreciate the principles of operation of different Refrigeration and Air conditioning systems in total as well as the significance of the various component system.

TEXT BOOKS:

1. Arora, C.P., “Refrigeration and Air Conditioning”, McGraw Hill, 3rd ed, New Delhi, 2010.
2. Stoecker, W.F. and Jones J. W.,” Refrigeration and Air Conditioning”, McGraw Hill, New Delhi, 1986.

REFERENCES:

1. Roy J. Dossat, “Principles of Refrigeration”, Pearson Education Asia, 4th ed, 2009.
2. “ASHRAE Hand book”, Fundamentals 2010
3. Jones W.P., “Air conditioning engineering”, Elsevier Butterworth-Heinemann, 5th ed, 2001.

PTML7001	RELIABILITY CONCEPTS IN ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE

- To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods

UNIT I RELIABILITY CONCEPT 9

Reliability definition –Reliability parameters- f(t), F(t) and R(t) functions- Measures of central tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality - Useful life.

UNIT II LIFE DATA ANALYSIS 9

Data classification – Non parametric methods: Ungrouped, Grouped, Complete, Censored data – Time to failure distributions – Probability plotting: Exponential, Weibull - Goodness of fit tests – Survival graphs.

UNIT III RELIABILITY ESTIMATION 9

Series parallel configurations – Parallel redundancy – m/n system – Complex systems: RBD approach – Baye's method – Minimal path and cut sets - Fault Tree analysis – Standby system.

UNIT IV RELIABILITY MANAGEMENT 9

Reliability testing: Failure terminated test – Time terminated test – Upper and lower MTBFs – Sequential Testing – Reliability growth monitoring – Reliability allocation.

UNIT V RELIABILITY IMPROVEMENT 9

Analysis of downtime – Repair time distribution – Maintainability prediction – Measures of maintainability – Availability definitions – System Availability – Replacement decisions – Economic life.

TOTAL: 45 PERIODS

OUTCOME

- The course enable student the application of reliability in various field of engineering.

REFERENCES:

1. An Introduction to Reliability and Maintainability Engineering, Charles E.Ebeling, TMH, 2000.
2. Roy Billington and Ronald N. Allan, Reliability Evaluation of Engineering Systems, Springer, 2007.
3. Reliability Engineering, Srinath L S, East West Publisher, 4th edition.

PTME7022	THEORY OF METAL FORMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on plasticity, surface treatment for forming of various types of metal forming process.
- To study the basic concepts of metal forming techniques and force calculation in metal forming process.
- To study the thermo - mechanical regimes and its requirements in metal forming.

UNIT I THEORY OF PLASTICITY 9

Theory of plastic deformation–Yield criteria–Tresca and von-Mises–Distortion energy–Stress-strain relation–Mohr's circle representation of a state of stress–cylindrical and spherical co-ordinate systems–upper and lower bound solution methods–Overview of FEM applications in Metal Forming.

UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES 9

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction–calculation of forces, work done–Process parameters, equipment used –Defects–applications–Recent advances in Forging, Rolling, Extrusion and Drawing processes–Design consideration in forming.

UNIT III SHEET METAL FORMING 9

Formability studies–Conventional processes–HERF techniques–Superplastic forming techniques – Hydro forming–Stretch forming–Water hammer forming–Principles and process parameters–Advantage, Limitations and application.

UNIT IV POWDER METALLURGY AND SPECIAL FORMING PROCESSES 9

Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling – Tooling, process parameters and applications - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking –LASER beam forming.

UNIT V SURFACE TREATMENT AND METAL FORMING APPLICATIONS 9

Experiment techniques of evaluation of friction in metal forming selection – influence of temperature and gliding velocity – Friction heat generation – Friction between metallic layers – Lubrication carrier layer – Surface treatment for drawing, sheet metal forming, Extrusion, hot and cold forging. Processing of thin Al tapes – Cladding of Al alloys – Duplex and triplex steel rolling Thermo mechanical regimes of Ti and Al alloys during deformation – Formability of welded blank sheet – Laser structured steel sheet - Formability of laminated sheet.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of the course the students will be able to:

- Use of mechanical and thermodynamics principle of plastic deformation to form the components using different metal forming techniques.

TEXT BOOKS:

1. Surender Kumar, “Technology of Metal Forming Processes”, Prentice Hall India Publishers, 2008.
2. Nagpal G.R., “Metal Forming Processes”-Khanna publishers, 2005.

REFERENCES:

1. Helmi A Youssef, Hassan A. El-Hofy, “Manufacturing Technology: Materials, Processes and Equipment”, CRC publication press, 2012.
2. SAE Transactions, “Journal of Materials and Manufacturing Section 5”, 1993 – 2007.
3. Dieter,G.E,”Mechanical Metallurgy” TMH, Third edition March 2013.
4. Marciniak,Z., Duncan J.L., Hu S.J., “Mechanics of Sheet Metal Forming”, Butterworth-Heinemann An Imprint of Elesevier, 2006.
5. Altan T., “Metal forming – Fundamentals and applications” – American Society of Materials Park, 2003.
6. “ASM Hand book, Forming and Forging”, Ninth edition, Vol – 14, 2003.
7. Shiro Kobayashi,Soo-Ik Oh,Taylan Altan-“,Metal forming and Finite Element Method”, Oxford University Press, 2001.
8. Proc. Of National Seminar on - Advances in Metal Forming MIT, March 2000.

PTGE7074 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning--Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma Process Capability– Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

PTME7023	TURBO MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the process of energy transfer and operating principles of various turbomachines and their use for various engineering applications.

UNIT I WORKING PRINCIPLES 9

Classification of Turbomachines. Energy transfer between fluid and rotor - Euler equation and its interpretation. Velocity triangles. Thermal, Mechanical and overall efficiencies. Polytropic efficiency. Degree of reaction. Dimensionless parameters for Turbomachines.

UNIT II CENTRIFUGAL FANS AND BLOWERS 9

Types – components – working. Flow analysis in impeller blades-volute and diffusers. Velocity triangles - h-s diagram. Performance characteristic curves – various losses.

UNIT III CENTRIFUGAL COMPRESSOR 9

Components - Impeller types. Velocity triangles - h-s diagram. slip factor and power input factor. Performance characteristics and various losses. Geometry and performance calculation.

UNIT IV AXIAL FLOW COMPRESSOR 9

Construction details. Work done factor. Stage velocity diagrams - h-sdiagram. Performance characteristics, efficiency and stage losses. Vortex theory.

UNIT V AXIAL AND RADIAL FLOW TURBINES 9

Components - Types - Stage velocity diagrams - impulse and reaction stages. Performance coefficients and losses. Multistaging. Optimum conditions. Performance characteristics.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to:

- Explain the various systems, principles and applications and different types of turbo machinery components.

TEXT BOOKS:

1. Yahya, S.M., “Turbines, Compressor and Fans”, 4th Edition, Tata McGraw Hill, 2011.
2. Ganesan, V., “Gas Turbines”, 3rd Edition, Tata McGraw Hill, 2011.

REFERENCES:

1. Saravanamutto, Rogers, Cohen, Straznicky., “Gas Turbine Theory”, 6 th Edition, Pearson Education Ltd, 2009.
2. Bruno Eck.,” Fans; design and operation of centrifugal, axial-flow, and cross-flow fans”, Pergamom Press, 1973.
3. Dixon, S.L., “Fluid Mechanics and Thermodynamics of Turbomachinery”, 7th Edition, Butterworth-Heinemann, 2014.
4. Shepherd, D.G., “Principles of Turbomachinery”, Collier Macmillan Ltd, 1961.
5. Stepanoff, A.J., “Blowers and Pumps”, John Wiley and Sons Inc. 1965.
6. Gopalakrishnan .G and Prithvi Raj .D,” A Treatise on Turbomachines”, Scitech Publications (India) Pvt. Ltd., 2nd Edition, 2008.

ANNA UNIVERSITY, CHENNAI 600 025
UNIVERSITY DEPARTMENTS
R 2017
B.E. (PART TIME) AUTOMOBILE ENGINEERING
I TO VII SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTGE7151	Computing Techniques	3	0	0	3
3.	PTGE7152	Engineering Mechanics	3	0	0	3
4.	PTPH7152	Materials Science	3	0	0	3
5.	PTPR7101	Production Processes	3	0	0	3
		TOTAL CREDITS	**15**	**0**	**0**	**15**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7201	Automotive Petrol Engines	3	0	0	3
2.	PTEI7205	Electrical and Electronics Engineering	3	0	0	3
3.	PTAE7201	Mechanics of Solids	3	0	0	3
4.	PTMA7251	Numerical Methods	3	0	0	3
5.	PTAU7202	Thermodynamics and Thermal Engineering	3	0	0	3
		TOTAL CREDITS	**15**	**0**	**0**	**15**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7301	Automotive Chassis	3	0	0	3
2.	PTAU7302	Automotive Diesel Engines	3	0	0	3
3.	PTAE7301	Engineering Fluid Mechanics and Machinery	3	0	0	3
4.	PTPR7301	Kinematics and Dynamics of Machines	3	0	0	3
PRACTICAL						
5.	PTAU7311	Automotive Engine and Chassis Components Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7401	Automotive Electrical and Electronics Systems	3	0	0	3
2.	PTAU7402	Automotive Transmission	3	0	0	3
3.	PTAU7403	Theory of Fuels and Lubricants	3	0	0	3
4.		Elective I	3	0	0	3
PRACTICAL						
5.	PTAU7411	Automotive Electrical and Electronics Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7501	Automotive Components Design	3	0	0	3
2.	PTAU7502	Automotive Pollution and Control	3	0	0	3
3.	PTAU7503	Vehicle Body Engineering	3	0	0	3
4.		Elective II	3	0	0	3
PRACTICAL						
5.	PTAU7511	Engine Testing and Emission Measurement Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7601	Advanced Vehicle Technology	3	0	0	3
2.	PTAU7602	Electronic Engine Management System	3	0	0	3
3.		Elective III	3	0	0	3
4.		Elective IV	3	0	0	3
PRACTICAL						
5.	PTAU7611	Vehicle Testing Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7701	Vehicle Dynamics	3	0	0	3
2.		Elective V	3	0	0	3
3.		Elective VI	3	0	0	3
PRACTICAL						
4.	PTAU7711	Project Work	0	0	9	6
		TOTAL CREDITS	**9**	**0**	**9**	**15**

TOTAL NO OF CREDITS: 101

LIST OF ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTAU7001	Advanced Theory of IC Engines	3	0	0	3
2.	PTAU7002	Alternative Fuels and Energy System	3	0	0	3
3.	PTAU7003	Automotive Aerodynamics	3	0	0	3
4.	PTAU7004	Automotive Automation	3	0	0	3
5.	PTAU7005	Automotive Materials	3	0	0	3
6.	PTAU7006	Automotive Test Instrumentation	3	0	0	3
7.	PTAU7007	Combustion Thermodynamics and Heat Transfer	3	0	0	3
8.	PTAU7008	Computational Fluid Mechanics	3	0	0	3
9.	PTGE7071	Disaster Management	3	0	0	3
10.	PTAU7009	Finite Element Techniques	3	0	0	3
11.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
12.	PTGE7073	Human Rights	3	0	0	3
13.	PTAU7010	Hybrid and Electric Vehicles	3	0	0	3
14.	PTAU7011	Hydraulic and Pneumatics Systems	3	0	0	3
15.	PTAU7012	Manufacturing of Automotive Components	3	0	0	3
16.	PTAU7013	Metrology and Measurement System	3	0	0	3
17.	PTAU7014	Noise, Vibration and Harshness	3	0	0	3
18.	PTAU7015	Off Highway Vehicles	3	0	0	3
19.	PTAU7016	Principles of Control Systems	3	0	0	3
20.	PTAU7017	Quality Control and Reliability	3	0	0	3
21.	PTPR7001	Quantitative Techniques in Management	3	0	0	3
22.	PTAU7018	Simulation of IC Engines	3	0	0	3
23.	PTGE7074	Total Quality Management	3	0	0	3
24.	PTAU7019	Two and Three Wheeler Technology	3	0	0	3
25.	PTAU7020	Vehicle Air-Conditioning	3	0	0	3
26.	PTAU7021	Vehicle Maintenance	3	0	0	3
27.	PTAU7022	Vehicle Multiplexing	3	0	0	3
28.	PTAU7023	Virtual Instrumentation in Automobile Engineering	3	0	0	3

PTMA7151 APPLIED MATHEMATICS L T P C
(Common to all branches of B.E / B.Tech (PT) Programmes) 3 0 0 3

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES 9

Characteristic equation – Eigen values and Eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION 9

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS 9

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUTCOMES :

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTGE7151	COMPUTING TECHNIQUES	L	T	P	C
	(Common to all branches of Engineering and Technology)	**3**	**0**	**0**	**3**

OBJECTIVE

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures - Unions

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the student should be able to:

- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort**.**
- Use programming language to solve problems.

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, "Programming with C", Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

PTGE7152 ENGINEERING MECHANICS L T P C

3 0 0 3

OBJECTIVE :

The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I STATICS OF PARTICLES 9

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle-Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point ,Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple-Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force-Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions-Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES 9

Centroids of lines and areas –symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies ,Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass -Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass-Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION 9

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance , Ladder friction.

UNIT V DYNAMICS OF PARTICLES 9

Kinematics-Rectilinear Motion and Curvilinear Motion of Particles.
Kinetics-Newton's Second Law of Motion -Equations of Motions , Dynamic Equilibrium, Energy and Momentum Methods Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact.

L–45 TOTAL: 45 PERIODS

OUTCOME:

Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw-Hill Education (India) Pvt. Ltd. 10th Edition, 2013.

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
2. J.L. Meriam& L.G. Karige, Engineering Mechanics: Statics (Volume I) and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
3. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008. Irving H. Shames, G. Krishna MohanaRao, Engineering Mechanics -Statics andDynamics, Fourth Edition–PHI / Pearson Education Asia Pvt. Ltd., 2006.
4. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

PTPH7152	MATERIALS SCIENCE	L	T	P	C
	(Common to Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering)	3	0	0	3

OBJECTIVE:

- To introduce the essential principles of materials science for mechanical and related Engineering applications.

UNIT I PHASE DIAGRAMS 9

Solid solutions - Hume Rothery's rules - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II FERROUS ALLOYS AND HEAT TREATMENT 9

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructue of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, baintic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

UNIT III MECHANICAL PROPERTIES 9

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS 9

Ferromagnetism – Domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites - dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials, properties, types and applications.

UNIT V NEW MATERIALS 9

Ceramics – types and applications – Composites: classification, role of matrix and reinforcement – processing of fiber reinforced plastics – Metallic glasses – types , glass forming ability of alloys – Inoue criteria – melt spinning process – applications - Shape memory alloys – phases, shape memory effect, pseudoelastic effect – NiTi alloy – applications- Nanomaterials – preparation: ball milling and chemical vapour deposition - properties and applications – carbon nanotubes - Biomaterials

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to apply the different materials, their processing, and heat treatments in suitable application in mechanical engineering fields.

TEXT BOOKS:

1. Raghavan, V. “Physical Metallurgy: Principles and Practice”, Phi Learning (2009).
2. Balasubramaniam, R. “Callister's Materials Science and Engineering”, Wiley India Pvt. Ltd. (2014).
3. Palanisamy P.K., “Materials Science” , Scitech (2013).

REFERENCES:

1. Raghavan, V. “Materials Science and Engineering”, Printice Hall of India (2007).
2. Shackelford, J.F. “Introduction to Materials Science for Engineers”. Pearson India (2006).
3. Donald Askeland. “Materials Science and Engineering”, Brooks/Cole (2010).
4. Smith, W.F., Hashemi, J. and R.Prakash. “Materials Science and Engineering”,Tata Mcgraw Hill Education Private Limited (2014).

PTPR7101	PRODUCTION PROCESSES	L	T	P	C
	(Common to Aero/Auto/Rubber and Plastics)	3	0	0	3

OBJECTIVES:

- To impart the knowledge about the various production processes available
- To expose the student on the principle and applications of the processes
- To make a decision on a relevant process based on the merits and demerits.

UNIT I CASTING PROCESSES 10

Methods of production processes – comparison – sand casting – mould, pattern, die – pattern allowances – materials – types – 2 and 3 box moulding process – steps involved – core function and core making – runner, riser, gate-purpose – construction, principle, merits, demerits and applications of die casting, shell moulding, investment casting, centrifugal casting, continuous casting squeeze casting.

UNIT II METAL FORMING PROCESSES 8

Definition and companion of hot and cold forming – Principle, construction, types, merits, demerits and application of forging, rolling, extrusion, spinning processes – sheet metal operations – Types of dies used – Principle of powder metallurgy – steps involved – merits, demerits and applications.

UNIT III MACHINING PROCESSES 9

Machine and machine tool – construction, types operations in the following machines with block diagrams – Lathe, Milling, Drilling and Grinding – Concept of NC/CNC machines – Comparison of CNC with conventional machines – sample manual part programming for CNC Lathe and milling.

UNIT IV WELDING PROCESSES 9

Types of joining – soldering, brazing, welding, Chemical and mechanical – Fusion welding process – Gas welding – flame types – applications = Arc welding – types of joint – electrode – power supply – edge preparation – weld symbol – filler material – flux/ shielding gases – arc theory – Construction and applications of types of arc welding – Manual, GTAW, GMAW, SAW, ESW – Thermit welding, Pressure welding – resistance welding – spot, seam, projection and flash butt welding – stud welding – friction stir welding – diffusion bonding.

UNIT V UNCONVENTIONAL MACHINING PROCESSES 9

Need for unconventional – Construction, working principle merits, demerits and applications with block diagram only for AJM, AWJM, USM, CHM, ECM, EDM, EBM, LBM, PAM and IBM.

TOTAL: 45 PERIODS

OUTCOMES:

- Has enough knowledge on the various process available to make a part.
- Confident to select the process to based on cost of time and quantities.
- Can determine processes for new materials.

TEXT BOOKS

1. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology - Anna University, 4/e, Pearson Education, 2014
2. P.C. Sharma, “A Text Book of Production Technology”, S.Chand and Co. Ltd., New Delhi, 2010.

REFERENCES:

1. B.H.Amstead, "Manufacturing Processes", Phillip F.Ostwald, L.Begemon, John Wiley and Sons, 8th Edition, 1998.
2. De Garmo, "Materials and Processes in Manufacturing", Prentice Hall of India, 8th Edition, 2008.
3. P.N.Rao, "Manufacturing Technology – I and II", Tata McGraw Hill Publishing Co., New Delhi – 2013.
4. Amitabha Ghosh, Asok Kumar Mallik, Manufacturing Science, EWP Pvt. Ltd, 2007

PTAU7201 AUTOMOTIVE PETROL ENGINES L T P C
3 0 0 3

OBJECTIVE

- To impart basic knowledge on IC engines and its types and to develop the knowledge on various additional systems which are helps to improve the engine characteristics. Also to give through knowledge on complete construction and working details of petrol engine and its different accessories.

UNIT I ENGINE CONSTRUCTION AND WORKING 9

Engine classifications, 4 stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air & Actual cycles. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials for engine components.

UNIT II FUEL AND IGNITION SYSTEM 9

Carburetor – requirements, working principle, types, different circuits – Compensation & Maximum power devices – Petrol injection in SI engines, Magneto coil and battery coil spark ignition system. Advance mechanism. Electronic ignition System – CDI.

UNIT III COOLING AND LUBRICATION SYSTEM 9

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system, Evaporative cooling system – Need for Lubrication system. Mist lubrication system, wet & dry sump lubrication, Properties of lubricants, properties of coolant – Recent Technologies.

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion in SI engine – Stages of combustion – Flame propagation – Rate of pressure rise – Abnormal combustion – pre ignition and knock in SI engines – effect of engine variables on knock – Different combustion chambers for SI engine –Factors controlling combustion chamber design.

UNIT V TWO STROKE ENGINES 9

Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging processes. Merits and demerits, scavenging efficiency, Scavenging pumps, Rotary valve engine.

TOTAL : 45 PERIODS

OUTCOMES

Student can able to,

- identify various components of petrol engines and its sub systems.
- understand the actual engine working principle and its related components

- enhance their knowledge on other sub systems like ignition , lubrication etc.
- understand basic knowledge on petrol combustion and its related parameters

TEXT BOOKS

1. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai, 2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York,1994.

REFERENCES

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books:Co., Scranton, Pennsylvania, 1988.
3. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.
4. Ellinger, H.E., Automotive Engines, Prentice Hall Publishers, 1992.

PTEI7205 ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES

- Gain knowledge on network theorems.
- Understand the basics of AC circuits and the terms related to AC circuits.
- Gain knowledge on construction and working principle of AC and DC machines.
- Get exposed to basic electronic devices and their applications.
- Gain knowledge on logic gates and their applications in digital electronics.

UNIT I BASIC CONCEPTS AND D.C. CIRCUIT ANALYSIS 9

Ohm's law - Ideal voltage and current sources-Independent sources -dependent sources-circuit elements - Kirchhoff's law - voltage and current division in series and parallel circuits-Node and Mesh analysis - Star/Delta transformations- Thevenin's , Norton's and Super position theorem.

UNIT II A.C. CIRCUITS 9

Sinusoidal voltage and current-RMS and average value of periodic waves - Form factor - Phase and Phase difference – Simple RC.RL and RLC circuits - series and parallel resonance - power and power factor – introduction to three phase systems – power measurement in 3 phase system.

UNIT III ELECTRICAL MACHINES 9

DC Generators: Construction-Principle of Operation-EMF Equation and Applications- DC Motors: Back EMF-Voltage and torque equation- Principle of transformer- EMF Equation - Tests on transformer - AC motors: Construction and basic Principle of Operation-Starting and Running torques.

UNIT IV ANALOG ELECTRONICS 9

Semiconductors - Characteristics of PN Junction Diode and Zener Diode– Half wave and Full wave Rectifiers. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics-Class A, B and C amplifiers (quantitative treatment).

UNIT V DIGITAL ELECTRONICS 9

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression-Combinational circuits- Design of adder, subtractor, encoders, decoders, multiplexers and demultiplexers-Flip flops.

TOTAL : 45 PERIODS

OUTCOMES

- Able to analyze and solve problems for all types of electrical networks by applying various theorems.
- Able to understand and solve problems for basic AC circuits.
- Will be in a position to suggest suitable AC/DC machines for a given application.
- Able to analyze the characteristics of electronic devices such as PN junction and other diodes.

REFERENCES

1. Charles K. Alexander and Matthew N. Q. Sadiku, "*Fundamentals of Electric Circuits*", Third Edition, Mc Graw-Hill International Edition, 2007.
2. Theraja, B.L., " A Text Books of Electrical Technology ", S.S.Chand and Co., New Delhi, 1998.
3. Sudhakar.A and Shyam Mohan.S.P, "C*ircuits and Networks Analysis and Synthesis"*, Fourth edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.
4. Boylestad & Nashelsky, "*Electronic Devices & Circuit Theory"*, Eighth edition, Prentice Hall Of India (P) Ltd., 2003.
5. Thomas L. Floyd, *"Electronic Devices",* Pearson Education, 9th Edition, 2011.
6. M. Morris Mano and Michael D. Ciletti, Digital Design, Pearson Education, 2013.

PTAE7201 MECHANICS OF SOLIDS L T P C
3 0 0 3

OBJECTIVES

- The objective of this course is to make the students to understand the concepts of stress and strain and their relationships by analysis of solids and structures, to analyze determinate and indeterminate axial members, torsional members, and beams, in order to determine axial forces, torque, shear forces, bending moments, stresses and deflections.

UNIT I STRESS-STRAIN – AXIAL LOADING 9

Definition of stress and strain- Stress-Strain relation- Relation between material constants.-Bar under axial loading- Statically determinate and indeterminate cases – Thermal stress-Impact Loading

UNIT II STRESSES IN BEAMS 9

Types of beams and loadings – Relation between shear force and bending moment - Shear force and bending moment diagrams – Euler beam theory - Bending stress in beams – Shear stress in beam – Composite beam.

UNIT III DEFLECTION OF BEAM 9

Various methods for statically determinate beams - Double integration method – Macaulay's method – Moment area method – Conjucate Beam method – Method of superposition

UNIT IV TORSION AND SPRINGS 9

Shear stress and twist relation for circular section – Comparison of hollow shaft and solid shaft – Compound shaft – Power transmission by circular shafts – Springs – Deflection expression for close coiled helical spring – Stress in springs.

UNIT V BIAXIAL STRESS 9

Thin walled cylinder under internal pressure – Principal stresses for general biaxial stress field – Mohr's circle - Stresses in combined loading

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the students are expected to

- Know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
- Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force-deformation, and stress-strain relationships to the solid and structural mechanics problems
- Analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
- Have physical insight into distribution of stresses and strains in structural members

TEXT BOOKS:

1. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, 3rd edition, 2004.
2. William A. Nash, Merle C. Potter, "Schaum's Outline of Strength of Materials", 6th Edition, McGraw Hill Education, 2014

REFERENCES:

1. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer publishers, 2013
2. R.K.Rajput, 'Strength of Materials', S Chand; 4th Rev. Edition 2007.
3. Timothy A. Philpot, "Mechanics of Materials: An Integrated Learning System," 3rd Edition, Wiley, 2012.
4. Ferdinand P. Beer, E. Russell Johnston Jr., John T. Dewolf and David Mazurek, "Mechanics of Materials," seventh edition, McGraw-Hill, 2014
5. Russell C. Hibbeler, "Mechanics of Materials", Ninth Edition, Pearson education, 2013
6. Roy R Craig, "Mechanics of Materials", Third Edition, John Wiley & Sons, 2011
7. James M Gere, Barry J Goodno, "Mechanics of Materials", Eighth Edition, Cengage Learning, 2012

PTMA7251 NUMERICAL METHODS L T P C

3 0 0 3

OBJECTIVES :

- To provide the mathematical foundations of numerical techniques for solving linear system, eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton - Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 9

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first and second order equations – Multi step methods - Milne's and Adams - Bashforth predictor - corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference methods for solving two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat - flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL : 45 PERIODS

OUT COMES :

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS :

1. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Burden, R.L and Faires, J.D, " Numerical Analysis " 9th Edition, Cengage Learning, 2016.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.
4. S. R. K. Iyengar, R. K. Jain, Mahinder Kumar Jain, "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New Age International Publishers, New Delhi, 2012.
5. Sankara Rao . K, " Numerical Methods for Scientists and Engineers" PHI Learning Pvt Ltd. New Delhi, 2007.

PTAU7202 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to introduce the basic principles of thermodynamics and thermal engineering via real world engineering examples, to show students how thermodynamics is applied in engineering practice.

UNIT I BASIC THERMODYNAMICS 09

Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth low, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes.

UNIT II AIR STANDARD CYCLES AND COMPRESSORS 09

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION 10

Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 08

Principles of refrigeration, Vapor compression – Vapor absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V HEAT AND MASS TRANSFER 09

Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Basics of Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat exchangers, Logarithmic Mean Temperature Difference (LMTD) for parallel flow and Arithmetic Mean Temperature Difference (AMTD) counter flow heat exchangers.

TOTAL:45 PERIODS

(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)

OUTCOMES:

- Students will demonstrate a basic understanding of the nature of the thermodynamic processes for pure substances of ideal gases
- Student will demonstrate a basic understanding of the First law Thermodynamics and its application to systems and control volumes
- To analyze any problem in an engineering approach based on basic concepts and logic sequences.
- To understand the basics and modes of heat transfer, Refrigeration and Air-conditioners**.**

TEXT BOOKS:

1. Chattopadhyay. P Engineering Thermodynamics", oxford University Press, New Delhi, 2010.
2. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
3. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics" Prentice-Hall India, 2005.

REFERENCES:

1. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006
2. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
4. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
6. Mathur& Sharma Steam Tables, Jain Publishers, New Delhi.

PTAU7301 AUTOMOTIVE CHASSIS L T P C
3 0 0 3

OBJECTIVES:

- The student shall gain appreciation and understanding function of front axle, types of stub axle, types of steering gear box, Shall be able to understand need of suspension and its types, types of tyre, tyre specification, tyre rotation, Student shall gain knowledge of design consideration braking system, suspension system and for chassis

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 9

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, Types of Front Axles and Stub Axles, Front Wheel Geometry. Condition for True Rolling Motion. Ackerman’s and Davi’s Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power Steering.

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Final drive, different types of final drive, Worm and Worm wheel, straight bevel gear, spiral bevel gear and hypoid gear final drive. Differential principle. Constructional details of differential unit, Differential housings, Non–Slip differential, Differential locks.

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9

Construction of rear axles, Types of Loads acting on rear axles, Full –Floating, Three–Quarter Floating and Semi–Floating Axles, Twist beam rear axle, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details. tubeless, cross ply radial type, tyre sizes and designation

UNIT IV SUSPENSION SYSTEM 9

Requirement of Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf spring, Coil and Torsion bar Springs, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details of Leaf and Coil Springs, Sprung and unsprung mass, torsion bar springs.

UNIT V BRAKE SYSTEMS 9

Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, drum brake and disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders – antilock braking systems(ABS).

TOTAL : 45 PERIODS

OUTCOMES

- Ability to know the steering geometry, what should be the tyre pressure for different vehicle, which type of brakes are best for vehicle.
- Ability to recognize which safety systems are best for vehicle and also for safety consideration.

TEXT BOOKS

1. Newton Steeds and Garret, “Motor Vehicles” 13th Edition, Butterworth, London, 2005.
2. Heinz Hazler, “Modern Vehicle Technology”, Butterworth, London, 2005.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.

REFERENCES

1.Heldt P.M., “Automotive Chassis” Chilton Co., New York, 1990.
2.Giri. N.K., “Automotive Mechanics” Khanna Publishers, New Delhi, 2005.
3.“Motor Vehicles”, Newton, Steed and Garrot, 13th Edition, Butterworth London.
4.“Vehicle and Engine Technology”, Heisler, Second Edition SAE International Publication.

PTAU7302 AUTOMOTIVE DIESEL ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge on basic concepts of automotive diesel engines, combustion process involved in diesel engines and the various subsystems used along with their functions in detail.

UNIT I BASICS OF DIESEL ENGINES 9

Diesel engine classification, construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel - air and actual cycle analysis problems. Diesel fuel properties. Ignition quality of diesel. Cetane number and cetane Index. Laboratory tests for diesel fuel. Standards and specifications.

UNIT II FUEL INJECTION IN DIESEL ENGINES 9

Requirements – solid injection. Function of components – conventional fuel injection system, common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Types of injection nozzle, Nozzle tests. Electronic fuel injection. Spray characteristics. Injection timing. Pump calibration. Split and Multiple injection. Mechanical and pneumatic governors.

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 9

Air intake systems – Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting combustion. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – M-Combustion chamber. Combustion chambers for HCCI engines.

UNIT IV SUPERCHARGING AND TURBOCHARGING 9

Necessity and limitation of supercharging. Thermodynamic cycle with super charging. Types of supercharging and turbocharging – Relative merits. Intercooler. Matching of turbocharger.

Modification of an engine for supercharging. Effect of supercharging on engine performance. Variable geometry and variable nozzle turbocharger. E-Turbocharger. Problems.

UNIT V ENGINE TESTING AND RECENT DEVELOPMENTS 9

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Heat balance – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, HCCI and RCCI engines. Problems.

TOTAL : 45 PERIODS

OUTCOMES

- On completion of the course the students will understand the basic principle of operation of diesel engine, its subsystems
- The students can be able to apply their knowledge in operating the diesel engine and analyzing the engine performance characteristics.

TEXT BOOKS

1. V. Ganesan, Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.
2. M.L. Mathur and R.P.Sharma, Internal Combustion Engine, Dhanpath Rai Publications (P) Ltd, New Delhi 110002

REFERENCES

1. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
2. Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
3. Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co.,Scranton, Pennsylvania, 1988.
4. Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
5. Heinz Hesiler, Advanced engine technology. Butterworth Heinmann publications

PTAE7301 ENGINEERING FLUID MECHANICS AND MACHINERY L T P C
3 0 0 3

OBJECTIVE:

- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy. The applications of the conservation laws to flow though pipes and hydraulics machines are studied.

UNIT I INTRODUCTION 8

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor loses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 8

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV TURBINES 10

Impact of jets - Euler's equation - Theory of roto-dynamic machines-Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner –. Specific speed - unit quantities – performance curves for turbines .

UNIT V PUMPS 10

Various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

TOTAL: 45 PERIODS

OUTCOME:

- On completion of the course, students will be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to simple problems.

TEXT BOOKS:

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, Ninth edition,2015.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:

1. Ramamurtham. S, Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Co Pvt., Ltd, 9th edition, 2012.
2. Kumar. K.L. Engineering Fluid Mechanics (VII Ed.) S Chand publishers Reprint Edition 2006 edition (1 December 2010)
3. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.

PTPR7301 KINEMATICS AND DYNAMICS OF MACHINES L T P C
3 0 0 3

OBJECTIVE:

- To understand the basic concepts of mechanisms and machinery.

UNIT I MECHANISMS 10

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint and motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION 9

Types of friction – friction in screw and nut – screw – plate and cone clutch – belt (Flat and V) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III GEARS AND CAMS 9

Gear – Types and profile – nomenclature of spur and helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV VIBRATION 9

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of– critical speed of shafts.

UNIT V BALANCING 8

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines

TOTAL:45 PERIODS

OUTCOME:

The student shall be able to apply the kinematics and dynamics of machinery in design and analysis of engineering problems.

TEXT BOOKS:

1. Bansal R.K., "Theory of Machines", Laxmi Publications Pvt Ltd., New Delhi, 20th edition 2009.
2. Rattan S.S., "Theory of machines", Tata McGraw Hill publishing Co., New Delhi, 2nd edition 2011.

REFERENCES:

1. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Second Edition, Wiley Eastern Limited, 2006.
2. Malhotra D.R. and Gupta H.C , "The Theory of machines", Satya Prakasam, Tech. India Publications, 2008.
3. Gosh A and Mallick A.K., "Theory of Machines and Mechanisms", Affiliated East West press, 2009.
4. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw Hill, 2006.

PTAU7311	AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LABORATORY	L T P C 0 0 3 2

OBJECTIVES:

- To familiarize and train the students on the constructional arrangements of different engine system.
- Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts.
- To familiarize and train the students on the constructional arrangements of different engine system.

LIST OF EXPERIMENT FOR AUTOMOTIVE ENGINE

1. Study the layout of chassis system
2. Study the layout of steering systems with different Steering gearboxes
3. Dismantling, study and Assembling of Transfer case
4. Dismantling, study and Assembling of Constant Velocity Joint(Front Axles)
5. Dismantling, study and Assembling of Clutch.
6. Dismantling, study and Assembling of sliding mesh gear box
7. Dismantling, study and Assembling of Constant mesh gear box
8. Dismantling, study and Assembling of Syncro mesh gear box
9. Dismantling, study and Assembling of Differential.
10. Study the Layout of Rear Axle.
11. Study the Layout of Braking system.
12. Study of different types of suspension system.
13. Study the Automatic transmission system.

STUDY OF THE FOLLOWING ENGINES AND ITS COMPONENTS:

1. Single Cylinder Four Stroke Diesel Engine
2. Two wheeler Two stroke Petrol engines
3. Two wheeler Four Stroke Petrol Engine
4. Three wheeler Engine
5. Multi cylinder inline diesel engine
6. Multi cylinder inline Petrol engine
7. Multi cylinder V type diesel Engine
8. MPFI engine
9. CRDI engine

TOTAL: 30 PERIODS

OUTCOMES

- Dismantle and Assemble the automobile chassis and Engine components
- Identify & differentiate components of SI & CI engines
- Understand working of braking, steering, clutch, transmission, Suspension systems.
- Differentiate various subsystems of two, three & Four wheeler vehicles
- Train on various types of frames.
- Develop skills in Dismantling and assembling of chassis components.
- Correct minor repairs and trouble shoots the breakdowns.

PTAU7401	**AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

- Knowledge in vehicle electrical and electronics components for engine operation.
- Enhancing the knowledge of revsor and microprocessor applications in vehicle control systems.
- Gaining information's on modern safety system in vehicle braking.

UNIT I BATTERIES AND STARTING SYSTEM **10**

Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.

UNIT I CHARGING SYSTEM LIGHTING AND ACCESSORIES 9

DC Generators and Alternators their characteristics. Control unit – cut out, electronic regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design. Dashboard instruments. Horn, trafficator.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM 9

Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems.

UNIT IV SENSORS AND MICROPROCESSORS IN AUTOMOBILES 9

Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

UNIT V SAFETY SYSTEMS 8

Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.

TOTAL : 45 PERIODS

OUTCOMES:

- The student will have to know about all automotive electrical and electronic components used in a vehicle.

REFERENCES:

1. Judge. A.W., modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992
2. Young.A.P., & Griffiths.L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990
3. Spreadbury. F.G., Electrical Ignition Equipment, Constable & Co Ltd., London, 1962
4. Robert N Brady Automotive computers and Digital Instrumentation. A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.

PTAU7402 AUTOMOTIVE TRANSMISSION L T P C

3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices, automatic transmission system and electric drive used in road vehicles. At the end of course the students will have command over both mechanical transmission system, automatic transmission systems and their applications.

UNIT I CLUTCH 9

Requirement of transmission system, Types of transmission system, Clutches – Functions-Types of clutches, construction and operation of Single plate, multi plate and Diaphragm spring clutches.

UNIT II GEAR BOX 9

Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications.

UNIT III HYDRODYNAMIC TRANSMISSION 9

Fluid coupling – principles - Performance characteristics – advantages – limitations – drag torque – reduction of drag torque. Torque converter - principles - Performance characteristics – advantages – limitations – multistage and polyphase torque converters.

UNIT IV AUTOMATIC TRANSMISSION 9

Introduction to epicycle gear trains, Wilson gear box-Cotal electric transmission. Chevrolet "Turboglide" transmission. – four speed longitudinally mounted automatic transmission - Hydraulic control systems of automatic transmission. Continuously Variable Transmission (CVT) – types – Operations.

UNIT V HYDROSTATIC DRIVE AND ELECTRIC DRIVE 9

Hydrostatic drive; various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drive-types- Principle of early and modified Ward Leonard Control system-Advantages & limitations.

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of the course, students will

- acquire knowledge in the construction and working principle of different types of mechanical transmission system, hydrodynamic, hydrostatic devices and electric drives.
- design the mechanical transmission system namely clutches and Gearboxes.
- have command over automotive transmission concepts and its applications in modern vehicles.

TEXT BOOKS:

1. Heldt,P.M., Torque converters, Chilton Book Co., 1962.
2. Newton and Steeds, Motor vehicles, Illiffe Publishers, 1985.

REFERENCES:

1. SAE Transactions 900550 & 930910.
2. Hydrostatic transmissions for vehicle applications, I MechE Conference, 1981-88.
3. Crouse,W.H., Anglin,D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1976.
4. Heinz Heisler, Advance vehicle Technology, Butterworth-Heinemann.

PTAU7403 THEORY OF FUELS AND LUBRICANTS L T P C
3 0 0 3

OBJECTIVE

- To understand the basic of manufacturing of fuels and lubricants along with properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9

Introduction to Structure of petroleum, refining process-Distillation, cracking processes, Catalytic reforming, alkylation, isomerisation and polymerization, finishing process- blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II THEORY OF LUBRICATION 9

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT III LUBRICANTS 9

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNIT IV PROPERTIES AND TESTING OF FUELS 9

Properties and testing of fuels- density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion.

UNIT V FUEL RATING 9

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels. ASTM and SAE standards.

TOTAL : 45 PERIODS

OUTCOMES

Student would have basic understanding of

- Various refinery processes
- Theory of lubricants
- Properties and testing of fuels
- Fuel ratings

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma “A course in internal combustion engines”, Dhanpatrai publication, 2003.

REFERENCES

1. Arthur J Caines “Automotive lubricants Reference book”, SAE International, Second edition 2004
2. Keith Owen and Trevor Coley “Automotive fuels reference book” SAE International, second edition 1995
3. Francis, W – Fuels and Fuel Technology, Vol. I & II
4. Hobson, G.D. & Pohl.W- Modern Petroleum Technology

5. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press 1982.
6. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.
7. A R Lansdown “Lubrication and selection A practical guide” Third Edition,2014, Wiley

PTAU7411 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY **L T P C 0 0 3 2**

OBJECTIVE:

The main objective of this course is to impart practical knowledge in various automobile electrical and electronic components by testing, checking and programming.

LIST OF EXPERIMENTS:

1. Testing and checking of battery
2. Testing and checking of starting systems
3. Testing and checking of charging systems
4. Testing and checking of ignition systems
5. Study of automotive lighting system
6. Adjustment of head lights beam
7. Testing and checking of body controller systems
8. Logic gates, Adders, Flip flops
9. SCR and IC Timers
10. Interface circuit like amplifier, filter, Multiplexer and De Multiplexer
11. Interfacing seven segment displays
12. Basic microprocessor and microcontroller programming like arithmetic and Logic operation, code conversion, waveform generation, look up table etc
13. Interfacing ADC and DAC for Data Acquisition and Control Application
14. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
15. Display, Keyboard, Stepper Motor and DC Motor interface using microcontroller.
16. EPROM Programming
17. Study of Virtual Instrumentation

TOTAL : 45 PERIODS

OUTCOMES:

• Students will gain an understanding of the automobile electrical and electronic components.
• Student will read and analyze electrical and electronic circuits.
• Students will study the sensor and actuators interface through programming

PTAU7501 AUTOMOTIVE COMPONENTS DESIGN **L T P C 3 0 0 3**

OBJECTIVE:

To familiarize the various steps involved in the design process and understand the principles involved in design.

UNIT I INTRODUCTION **9**

Classification of design -Principle of Design optimization – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials –Determination of endurance limit for ductile materials – Notch sensitivity –Future trends – CAD Euler’s formula – Rankine’s formula – Tetmajer’s formula – Johnson formula – Reduction of stress Concentration

UNIT II DESIGN OF SHAFTS AND SPRINGS 9

Introduction – Material-Types-Standard size –Stresses in shaft –Design of shafts subjected to bending moment only, twisting moment only, and combined loading –Design of rear axle. Spring material- Types –Design of closed coiled helical springs and leaf springs.

UNIT III DESIGN OF FLYWHEELS 9

Introduction- Coefficient of Fluctuation of Speed - Fluctuation of Energy - Coefficient of Fluctuation of Energy. Design of Flywheel Rim, Flywheel Arms. Design of Hub - Key.

UNIT IV DESIGN OF BEARINGS 9

Types of bearings – Sliding contact bearings –Rolling contact bearings .Bearing life –Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise. Design of journal bearings - Ball and Roller bearings

UNIT V GEAR DESIGN 9

Types of gears **-** Terminology of gears- Design considerations – strength of gear teeth – Lewis equation —Dynamic tooth load – Design of spur gears – helical gears – herringbone gears – bevel gears and worm gears.

TOTAL :45 PERIODS

OUTCOMES:

The students will be able

- To identify the design requirements for any specific components.
- To design transmission parts.
- To explain the requirements of flywheel.

TEXT BOOK

1. Jain,R.K., Machine Design, Khanna Publishers, 1992.
2. Sundararaja Murthy,T.V., Machine Design, Khanna Publishers, New Delhi, 1991.
3. Bhandari,V.B., Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

REFERENCES

1. Hall Allen,S. & Others, Machine Design, Schaum Publisher Co., 1982.
2. Sigley, Machine Design, McGraw Hill, 1981.
3. Design Data Book, PSG College of Technology, Coimbatore, 1992.

PTAU7502 AUTOMOTIVE POLLUTION AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in automotive pollution control.
- The detailed concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

UNIT I INTRODUCTION 6

Introduction to SI Engine Combustion, CI Engine Combustion. Pollutants – sources – formation – effects of pollution on environment, human. Transient operational effects on pollution – Regulated – Unregulated emissions - Emission Standards. Introduction to noise pollution.

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL 10

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NOx, Smoke - Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL 10

Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES 9

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design.

UNIT V TEST PROCEDURES AND EMISSION MEASUREMENTS 10

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems - Emission analyzers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TOTAL : 45 PERIODS

OUTCOMES:

By the end of this course, students will be able to

- Understand the various emissions formed in IC engines
- Understand the effects of pollution on human health and environment
- Understand the control techniques
- Understand the emission norms

TEXT BOOKS:

1. Springer and Patterson, Engine Emission, Plenum Press, 1990.
2. B.P.Pundir, " IC Engines Combustion and Emissions" Narosa Publishers, 2010

REFERENCES:

1. Ramalingam. K.K., Internal Combustion Engines, Scitech Publications, Chennai, 2003.
2. Ganesan,V., Internal Combustion Engines, Tata McGraw Hill Co., 1994.
3. SAE Transactions, Vehicle emission, 1982 (3 volumes).
4. Taylor,C.F., Internal Combustion Engines, MIT Press, 1972.
5. Heywood,J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
6. Automobiles and Pollution SAE Transaction, 1995.

PTAU7503 VEHICLE BODY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamics, paneling of passenger car and commercial vehicle body design. At the end of the course the student will be well versed in the design and construction of external body of all types of vehicles such as car, light commercial vehicles and heavy commercial vehicles.

UNIT I CAR BODY DETAILS 10

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Safety: Safety design, safety equipment for cars.

UNIT II BUS BODY DETAILS 9

Types of bus body: based on capacity, distance travelled and based on construction.– Bus body lay out, floor height, engine location, entrance and exit location. Types of metal sections used – Regulations – Constructional details: Conventional and integral.

UNIT III COMMERCIAL VEHICLE DETAILS 8

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of Flat platform body, Tipper body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design.

UNIT IV VEHICLE AERODYNAMICS 9

Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.

UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR 9

Types and properties of materials used in body construction-Such as steel sheet, timber, plastics and GRP. Body trim items-body mechanisms. Hand tools-power tools for body repair. Vehicle corrosion-Anticorrosion methods-Modern painting process procedure.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects of car body, bus body and commercial vehicle bodies.
- Role of various aerodynamic forces and moments, measuring instruments in vehicle body design.
- Knowledge about the material used in body building, tools used in body repairs and command over vehicle body engineering applications.

TEXT BOOKS:

1. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.
2. James E Duffy, Body Repair Technology for 4-Wheelers,Cengage Learning,2009.

REFERENCES:

1. Giles, G.J., Body construction and design, Illiffe Books Butterworth & Co., 1991.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1992.
3. Braithwaite, J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1997.
4. Dieler Anselm., The passenger car body, SAE International, 2000

PTAU7511	ENGINE TESTING AND EMISSION MEASUREMENT LABORATORY	L T P C 0 0 3 2

OBJECTIVE:

- The main objective of this course is to impart knowledge in automotive Emission measurement and methods of testing engines. The detailed measuring techniques of pollutants like UBHC, CO, NOx, CO_2 and smoke for both SI and CI engines will be taught and compared with the emission standards. The knowledge about the instruments used for measurement of pollutants, engine performance and combustion parameters are to be explained with live example. At the end of the course the students will have knowledge about methods to test the engine and emission.

LIST OF EXPERIMENTS:

1. Study and use of IC engine testing Dynamometers.
2. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
3. Performance study on petrol engine.
4. Performance study on diesel engine.
5. Determine the Frictional power on petrol engines.
6. Heat balance test on an automotive diesel engine.
7. Study of NDIR Gas Analyzer and FID.
8. Study of Chemiluminescent NO_x analyser.
9. Measurement of HC, CO, CO_2, O_2 and NO_x using exhaust gas analyzer.
10. Diesel smoke measurement.

TOTAL : 30 PERIODS

OUTCOMES:

By the end of this course, students will be able to

- Understand the various emission measuring instruments
- Understand the various engine testing instruments
- Understand the procedure to measure the emission
- Understand the procedure for measuring the engine performance and combustion parameters
- Understand the emission norms

TEXT BOOK:

1. Giles,J.G., Vehicle Operation and performance, Illiffe Books Ltd., London, 1989.

REFERENCES:

1. Crouse,W.H. and Anglin,D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
2. Ganesan,V., Internal Combustion engines, Tata McGraw Hill Co., 1994.
3. BIS Code Books, IS-10000 series, 1988.

PTAU7601	ADVANCED VEHICLE TECHNOLOGY	L T P C 3 0 0 3

OBJECTIVES

- The course should enable the students to know about the basics about the vehicle and to understand the safety aspects in the vehicle. It also enables to acquire knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle and to know about the comfort and convenience system.

UNIT I MODERN POWER PLANT AND POWER TRAIN 9

Modern Engine Technology like DTS- i, DTS – Fi, DTS – Si, VVT, Camless Engine, GDi, CRDI , Hybrid / Electric and Future Cars, Fuel Cell.

UNIT II PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM 9

Seat belt, Seat belt tightener system and importance , collapsible steering column. Air bags and its activation .Designing aspcets of automotive bumpers and materials for bumpers. Steering And mirror adjustment, central locking system, Tire pressure control system, rain sensor system, automated wiper system.

UNIT III ACTIVE SAFETY 9

Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection system.

UNIT IV VEHICLE INTEGRATION 9

Vision enhancement, road recognition system, Looking out sensors and Looking in sensors, intelligent vision system, Vehicle Integration system. Anti theft technologies, smart card system, number plate coding. Locking system- Central locking system- acoustic signaling devices.

UNIT V VEHICLE NAVIGATION SYSTEM 9

Traffic routing system - Automated highway systems - Lane warning system – Global Positioning System. Vehicle Navigation System. Road Network, Driver conditioning warning - Route Guidance and Navigation Systems- Driver Information System, driver assistance system.

TOTAL : 45 PERIODS

OUTCOMES:

The students should be able to:

- Know about the design of the bumper for safety.
- Know about the concept of crumble zone, and also the effect of acceleration and deceleration of the vehicle in the compartment of the vehicle.
- Know the various types of safety aspects such as active and passive safety, the active safety components and the working passive safety components such as air bags, seat belts
- Know the working of the compartment while moving of the vehicle, about the collapsible steering and tiltable steering column, about the collision avoidance system, front and rear object detection.

Know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central

TEXT BOOKS:

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”. Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., “Labview Advanced programming Techniques”,CRC Press, 2nd Edition, 2007.
3. Robert N.Brandy, “Automotive Electronics and Computer Systems”, Prentice Hall ,2001
4. Ljubo Vlacic, Michel Parent, Fumio Harashima – “Intelligent Vehicle Technologies Theory and Applications” -Butterworth-Heinemann, 2001
5. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - “Sensors for Automotive Applications “ - WILEY-VCH Verlag GmbH & Co. 2003
6. Robert Bosch GmbH - “Safety, Comfort and Convenience Systems”- Wiley; 3rd edition , 2007

REFERENCES:

1. Bosch, “Automotive HandBook”, 6th edition, SAE, 2004.
2. J.Powloski - “Vehicle Body Engineering” - Business books limited, London - 1969.
3. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.
4. ARAI Safety standards

PTAU7602 ELECTRONIC ENGINE MANAGEMENT SYSTEMS L T P C
3 0 0 3

OBJECTIVE

- The objective of the course is to make the student to understand the need, role, components, control strategies used in an engine management system. The student will be familiarized in the fundamentals, operation, function of various sensors and actuators in an engine. The student will gain knowledge on various systems related to ignition and injection system, and various engine control algorithm used during engine operation.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II SENSORS AND ACTUATORS 9

Working principles, construction and location of sensors to measure speed, load, air flow, temperature, pressure, lambda, throttle position, knock, etc. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc. Design constraints.

UNIT III SI ENGINE MANAGEMENT 9

Layout, types and working of SI engine management systems (K, KE, Mono Jetronic, L, LH, Motronic). GDI. Development of ignition system – Transistor assisted, Contactless, Distributor less, CDI, Ignition Map, Knock control. Flowcharts for combined fuel injection and ignition control. Introduction to LASER Ignition system.

UNIT IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Electronically controlled Unit Injection system. Common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter.

UNIT V DIGITAL ENGINE CONTROL SYSTEM 9

Control algorithm for different operating modes of engine. Pollution control devices. Integrated engine control system, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the student should able to

- Describe basic electronic engine management theory
- Define the function, construction and operation of various sensors and actuators
- Demonstrate the principles and application of computerized engine control devices and electronic fuel and ignition management systems in the modern automobile.

TEXT BOOKS:

1. William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.
2. Allan W. M. Bonnick, "Automotive Computer Controlled Systems", Butterworth-Heinemann, 2001.
3. Bosch, "Automotive Sensors", Robert Bosch GmbH, 2001.
4. Eric Chowanietz, “Automobile Electronics,” SAE, 1995.

REFERENCES:

1. Tom Denton, “Advanced Automotive Fault Diagnosis,” Second edition, Elsevier Butterworth-Heinemann, 2006
2. Diesel Engine Management by Robert Bosch, SAE Publications, 3rd Edition, 2004.
3. Gasoline Engine Management by Robert Bosch, SAE Publications, 2nd Edition, 2004.
4. Forbes Aird, "Bosch Fuel Injection Systems", HP Books, 2001.
5. Bosch, "Gasoline Fuel Injection System", Robert Bosch GmbH, 1995.

PTAU7611	VEHICLE TESTING LABORATORY	L T P C 0 0 3 2

OBJECTIVES :

- To impart the knowledge on testing of vehicle and subsystems.

LIST OF EXPERIMENTS:

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of braking system
6. Fault diagnosis and service of suspension system
7. Fault diagnosis and service of steering system
8. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system etc
9. Vehicle testing on chassis dynamometer
10. Practice the following:
    i. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
    ii. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
    iii. Wheel bearings tightening and adjustment.
    iv. Adjustment of head lights beam.
    v. Removal and fitting of tire and tube.

TOTAL : 30 PERIODS

OUTCOMES

- End of the course student would have deep practical knowledge on

PTAU7701 VEHICLE DYNAMICS L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to provide fundamental knowledge of the dynamics of ground vehicles, knowledge of suspension design and function, basic concepts on concerning stability and control and to study about basic analysis of vehicle dynamics in performance, handling and ride modes.

UNIT I CONCEPT OF VIBRATION 9

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT II TYRES 9

Tyre forces and moments, Tyre structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tyres. Magic formulae tyre model, Estimation of tyre road friction. Test on Various road surfaces. Tyre vibration.

UNIT III VERTICAL DYNAMICS 9

Human response to vibration, Sources of Vibration. State Space Representation. Design and analysis of Passive, Semiactive and Active suspension using Quarter car, Bicycle Model, Half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Power limited acceleration and traction limited acceleration. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

UNIT V LATERAL DYNAMICS 9

Steady state handling characteristics. Steady state response to steering input – Yaw velocity gain, Lateral acceleration gain, curvature response gain. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering. Minuro Plot for Lateral Transient Response,

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the courses, the students can able to

- Develop physical and mathematical models to predict the dynamic response of vehicles;
- Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response;
- Use dynamic analyses in the design of vehicles.

TEXT BOOKS:

1. Singiresu S. Rao, "Mechanical Vibrations," 5th Edition, Prentice Hall, 2010
2. J. Y. Wong, "Theory of Ground Vehicles", 4th Edition, Wiley-Interscience, 2008
3. Rajesh Rajamani, "Vehicle Dynamics and Control," 2nd edition, Springer, 2012
4. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014

REFERENCES:

1. Dean Karnopp, "Vehicle Dynamics, Stability, and Control", 2nd Edition, CRC Press, 2013
2. R. Nakhaie Jazar, "Vehicle Dynamics: Theory and Application", 2nd edition, Springer, 2013
3. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004
4. Hans B Pacejka, "Tyre and Vehicle Dynamics," 2nd edition, SAE International, 2005
5. John C. Dixon, "Tyres, Suspension, and Handling, " 2nd Edition, Society of Automotive Engineers Inc, 1996
6. Jan Zuijdijk, "Vehicle dynamics and damping," First revised edition, Author House, 2013.

PTAU7001 ADVANCED THEORY OF IC ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge in modern trends and developments in internal combustion engines. To develop knowledge in non conventional engines and their operation in detail and to acquire complete knowledge in engine modeling and combustion analysis of internal combustion engines

UNIT I COMBUSTION OF FUELS 9

Chemical composition and molecular structure of hydrocarbon fuels. Combustion Stoichiometry of hydrocarbon fuels – Chemical energy and heat of reaction calculations – Chemical equilibrium and adiabatic flame temperature calculation. Theory of SI and CI engine combustion – Flame velocity and area of flame front. Fuel spray characteristics – droplet size, depth of penetration and atomization.

UNIT II ENGINE CYCLE ANALYSIS 9

Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.

UNIT III COMBUSTION MODELLING 9

Basic concepts of engine simulation – Governing equations, Classification of engine models- Thermodynamic models for Intake and exhaust flow process – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.

UNIT IV NON CONVENTIONAL IC ENGINES 9

Concept of L.H.R. engine and its recent developments. Variable compression ratio engine and its use in engine research. Wankel rotary combustion engine. Dual fuel engine concept for multi fuel usage in CI engines - performance studies on dual fuel engine. Free piston engine. Stratified charge and lean burn engines . Locomotive and marine engines.

UNIT V COMBUSTION ANALYSIS IN IC ENGINES 9

Photographic studies of combustion processes – Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe's law analysis for combustion. Calculation of Ignition delay and combustion duration. – Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will understand the recent developments and trends in internal combustion engines. They will be able to apply their knowledge in making changes in engine design for better engine performance.
- Students will become familiar with the non conventional engines and their importance, difficulties involved in using them for power generation
- They will also get familiarized with the equipment used for flow and combustion analysis.

TEXT BOOKS

1. John,B., Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Co., New York, 1988.
2. Ramalingam. K.K., Internal combustion engines, Scitech publications, Chennai, 2003.

REFERENCES

1. Ganesan,V., Internal combustion engines, Tata McGraw Hill Publishing Co.,1994.
2. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.
3. Ganesan,V., Compute Simulation of Compression Ignition engine process, Universities Press (India) Ltd., Hyderabad, 1996.
4. Benson,R.S., Whitehouse,N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

PTAU7002 ALTERNATIVE FUELS AND ENERGY SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines. To develop knowledge in changing the engine system, modifying the fuel for efficient use in the internal combustion engines and to understand the challenges and difficulties in using alternative fuels in internal combustion engines

UNIT I INTRODUCTION TO ALTERNATIVE FUELS 9

Need for alternative fuels. World and Indian energy scenario on alternative fuels. Availability of different alternative fuels for SI and CI engines. Production technologies for biofuels for internal combustion engines- Pyrolysis, gasification, digestion.

UNIT II ALCOHOLS AS FUELS 9

Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.

UNIT III VEGETABLE OILS AS FUELS 9

Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines. Role of Nano fluids, additives and cetane improvers for performance improvement of vegetable oils as fuel.

UNIT IV HYDROGEN AS ENGINE FUEL 9

Production methods of hydrogen. Combustive properties of hydrogen. Problems associated with hydrogen as fuel and solutions. Different methods of using hydrogen in SI and CI engines. Performance, emission and combustion analysis in engines. Hydrogen storage - safety aspects of hydrogen.

UNIT V BIOGAS, LPG AND NATURAL GAS AS FUELS 9

Production methods of Biogas, Natural gas and LPG. Properties studies. CO_2 and H_2S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

TOTAL : 45 PERIODS

OUTCOMES

- Upon completion the course the students will have the complete knowledge on bio fuel production methods and their properties in detail.
- They will be able to apply their knowledge in making changes in engine design and fuel modification for the utilizing the alternative fuels effectively in the engines.

TEXT BOOKS

1. Richard L Bechtold P.E., Alternative Fuels Guide book, Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.
2. Donald Klass, Biomass for Renewable Energy, Fuels, and Chemicals, 1998, Academic Press, ISBN: 978-0-12-410950-6.

REFERENCES

1. Ayhan Demirbas, ' Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008,ISBN-13: 9781846289941
2. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS Press Champaign, Illinois 2005.
3. Technical papers of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
4. Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) on biofuels.

PTAU7003	AUTOMOTIVE AERODYNAMICS	L T P C
		3 0 0 3

OBJECTIVE

- To learn the basics of fluid mechanics on vehicle motion and expose to the optimization techiniques followed in automotive industry in reducing aerodynamics drag, fuel consumption and improving vehicle stability. This course will also expose the students to testing techniques practiced in industry.

UNIT I BASICS OF FLUID DYNAMICS ON VEHICLE MOTION 9

Importance of study - timeline developments -basics of fluid mechanics -flow phenomenon related to vehicles - external flow problem -various resistances to vehicle motion - performance, fuel consumption and traction force diagram of a passenger car.

UNIT II DRAG FRACTIONS AND LOCAL ORIGINS IN A PASSENGER CAR 9

Car as a bluff body - generation & transportation of vortices around car -types of aerodynamic drag forces& its contribution to total drag - analysis of aerodynamic drag at local origins - shape and detail optimization techniques with case studies.

UNIT III VEHICLE HANDLING 9

The origin of forces and moments on a vehicle - lateral stability problems - methods to calculate forces and moments – vehicle dynamics under side winds - the effects of forces and moments, dirt accumulation on the vehicle, wind noise. Add-ons to improve stability of road vehicles.

UNIT IV COMMERCIAL VEHICLE AERODYNAMICS 9

Tractive resistance & fuel consumption – Drag coefficients of various commercial Vehicles – Scope for reducing drag on commercial vehicles (Trucks with trailers and buses), Advantages of commercial vehicles aerodynamics & its effects – Vehicle soiling & its effects on driving.

UNIT V WIND TUNNELS FOR ROAD VEHICLES AERODYNAMICS 9

Need of a wind tunnel, principle of wind tunnel technology, problems with reduced scale models, full scale wind tunnels examples and case studies, instrumentation& measurement techniques, Introduction to numerical analysis (CFD).

TOTAL : 45 PERIODS

OUTCOMES :

- Know the forces & moments influencing drag
- Solve simple numericals related to fuel economy & drag
- Learn the techniques of optimization practiced in industry
- Learn the relation between drag, stability & fuel economy
- Expose to fundamentals of numerical & experimental testing

TEXT BOOKS:

1. R.H.Barnard - “Road vehicle aerodynamic design, An Introduction” , Mechaero publications, Third edition
2. Hucho .W.H. – “Aerodynamic of Road Vehicles – From Fluid Mechanics to Vehicle Engineering” , Society of Automotive Engineers,U.S,Fourth edition
3. Alan Pope, Jewel B. Barlow, William H. Rae “Low speed wind tunnel testing” , John Wiley & SonsThird edition

REFERENCES :

1. “Automotive Aerodynamic”, Update SP-706 – SAE – 1987
2. “Vehicle Aerodynamics” – SP-1145-SAE-1996.

PTAU7004 AUTOMOTIVE AUTOMATION L T P C
3 0 0 3

OBJECTIVE:

- To understand the various automated Automobile manufacturing activities and study the application of computer technology in the Automobile manufacturing activities.

UNIT I AUTOMATION IN AUTOMOBILE MANUFACTURING 9

Introduction: Automation-types, Introduction to CAD/CAM and CIM, evolution of CIM-Organization and information processing in manufacturing- Implementation of CIM- the future automated future .

UNIT II AUTOMATED MATERIAL HANDLING SYSTEMS 9

Automated assembly systems- Design principles and types – part feeding devices, automated material handling devices – conveyor systems- types and applications, AGVs – types and control applications ,rail guided vehicles-automated storage/retrieval systems-industrial robots-basic components-special features-applications.

UNIT III GROUP TECHNOLOGY AND FMS 9

Part families-visual-part classification and coding-production flow analysis, benefits of GT-FMS-workstations-FMS layouts configurations-computer control systems- planning the FMS- machine cell design-FMS application and benefits – automated work flow-automated flexible assembly systems.

UNIT IV AUTOMATED ASSEMBLY AND INSPECTION 9

Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

UNIT V SHOP FLOOR AND COMPUTER AIDED QUALITY CONTROL 9

Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will have a sound knowledge in the various automated manufacturing process.
- Students will be familiar in modern engineering manufacturing process and will have an update in recent scenario

TEXT BOOKS:

1. Mikel P.Groover “Automation production systems and computer integrated manufacturing“ Prentice Hall of india PVT LTD 1995.

REFERENCES:

1. N.Viswanathan and Y.Navahari “performance modelling of automated manufacturing systems” Prentice hall of India PVT LTD ,1995.
2. Mulachy .D.E “Material handling hand book” McGraw hill, New York ,1999
3. GROOVER M.P “Plant layout and automation”, John Wiley & sons Inc. New York 1994.
4. BLACK J.T “The design of factory with a future” McGraw hill inc, New York ,1991.

PTAU7005	AUTOMOTIVE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Knowledge on properties of engineering materials
- To select suitable materials for design
- Materials selection criteria for engine and transmission systems
- Different materials used for automotive structures.
- Different electronic materials for automotive applications

UNIT I ENGINEERING MATERIALS AND THEIR PROPERTIES 9

Classes of engineering materials - the evolution of engineering materials, Definition of materials properties, Displaying material properties using materials selection charts, Forces for change in materials selection and design, Materials and the environment-selection of materials for automotive, aerospace, marine and defence applications.

UNIT II BASIS OF MATERIAL SELECTION 9

Selection strategy, Attribute limits and Material indices, structural index Selection procedure: Design process - types of design, design requirements, Function, Material attributes, Shape and Manufacturing processes - Materials processing and design processes and their influence on design, Process attributes, Systematic process selection, Process selection diagrams, Process cost, Energy consumption for production, Material costs, Availability, Recyclability, Environmental consideration. Computer aided selection.

UNIT III MATERIALS FOR ENGINES AND TRANSMISSION SYSTEMS 9

Materials selection for IC engines: Piston, piston rings, cylinder, Engine block, Connecting rod, Crank shaft, Fly wheels, Gear box, Gears, Splines, Clutches.

UNIT IV MATERIALS FOR AUTOMOTIVE STRUCTURES 9

Materials selection for bearings, leaf springs, chasis & frames, Bumper, shock absorbers, wind screens, panels, brake shoes, Disc, wheels, differentials , damping and antifriction fluids, Tyres and tubes.

UNIT V ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS 9

Materials for electronic devices meant for engine control, ABS, Steering, Suspension, Sensors, anti-collision, Anti-fog, Head lamps.

TOTAL: 45 PERIODS

OUTCOMES

- Discuss different materials used for automotive component manufacturing.
- Select proper material for Automobile applications

TEXT BOOKS

1. Gladius Lewis, “Selection of Engineering Materials”, Prentice Hall Inc. New Jersey USA, 1995.
2. Charles J A and Crane. F A. A., “Selection and Use of Engineering Materials”, 3rd Edition, Butterworths, London UK, 1996.

REFERENCES

1. James A. Jacobs, Thomas F. Kilduff., “Engineering Materials Technology: Structure, Processing, Properties & Selection”, Prentice Hall, USA, 1996.
2. ASM Handbook, “Selection of Materials Vol. 1 and 2”, ASM Metals Park, Ohio. USA, 1991.
3. M F Ashby, “Materials Selection in Mechanical Design”, third edition, Butterworth-Heineman, New York, 2005.
4. ASM Handbook. “Materials Selection and Design”, Vol. 20- ASM Metals Park Ohio.USA, 1997.
5. Cantor,“ Automotive Engineering: Lightweight, Functional, and Novel Materials”, Taylor & Francis Group, London, 2006

PTAU7006 AUTOMOTIVE TEST INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES

- To develop complete knowledge in using sensors, actuators and instruments in automobiles. To understand their necessities, working principles and performance characteristics in detail and to impart knowledge in modern laboratory experimental techniques for testing automobiles

UNIT I MEASUREMENT SYSTEMS 9

Introduction to Measurement systems-static and dynamic measurement –closed and open loop system - Requirements and characteristics – Analysis of experimental detail. Error analysis

UNIT II TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES 9

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

UNIT III MECHANICAL MEASUREMENT 9

Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES 9

I.S Code for Engine testing – Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature, Dynamic Cylinder pressure measurements.

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES 9

Laboratory tests- Study of chassis dynamometer- test tracks - Endurance Tests- crash tests- Vehicle performance test – Brake tests.

TOTAL: 45 PERIODS

OUTCOMES

- Upon completion of the course the students will be able to apply their knowledge in using all kind of sensors, actuators and instruments used in automobile testing
- They will be able to apply their knowledge in conducting different types of experiments in automobiles

TEXT BOOKS

1. Ernest O. Doebelin. Measurement systems: application and design. McGraw Hill Publishing Co, 2004, ISBN 0–07–243886–X.
2. Nicos Ladommatos and Hua Zhao, Engine Combustion Instrumentation and Diagnostics. SAE International, 2001-01-30, ISBN of 978-0-7680-0665-0.

REFERENCES

1. A.W. Judge, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
3. D.Patambis, Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co, New Delhi, 1990.
4. Rangan, Sharma and Mani, Instrumentation Devices and systems, Tata McGraw Hill Publishing Co., Ltd., 1990
3. J.G. Giles, Engine and Vehicle Testing, Illiffe books Ltd., London, 1968.

PTAU7007 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER **L T P C**
3 0 0 3

OBJECTIVES

- To make the students understand the principle of general and engine combustion.
- To understand engine heat release rate and various heat transfer models and to study the experimental methods for combustion and heat transfer in engines.

UNIT I THERMODYNAMICS OF COMBUSTION **9**

Premixed and diffusion combustion process in IC engines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT II CHEMICAL KINETICS OF COMBUSTION **9**

Fundamentals of combustion kinetics, rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for Normal Combustion.

UNIT III FLAMES **9**

Laminar premixed – flame speed correlations- quenching, flammability, and ignition, flame stabilization, laminar diffusion flames, turbulent premixed flames-Reynolds and Damkohler numbers and their significance.

UNIT IV HEAT TRANSFER IN IC ENGINES **9**

Engine Heat transfer and heat Balance. Measurement of Instantaneous heat transfer rate. Heat transfer modeling. Heat transfer coefficients, radiative heat transfer.

UNIT V EXPERIMENTS IN IC ENGINES **9**

Cylinder pressure measurement. Rate of heat release calculation – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

OUTCOMES

- Upon completion the students will understand the principle of engine combustion and the various heat transfer models and measuring methods of engine heat transfer in derail
- They will understand thermodynamics of combustion, grasp the basics of normal, abnormal combustion and heat transfer in engines
- They also understand experimental techniques in investigating the combustion and heat transfer processes in IC engines

TEXT BOOK

1. John. B. Heywood,'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.

REFERENCES

1. Spalding. D.B., "Some fundamental of Combustion", Butterworth Science Publications, London, 1985.
2. Taylor. E.F. "The Internal Combustion Engines ", International Text Book Co., Pennsylvania, 1982.
3. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
4. Ashley Campbel, "Thermodynamic analysis of combustion engine", John book company, Newyork, 1979.

PTAU7008 COMPUTATIONAL FLUID MECHANICS L T P C
3 0 0 3

OBJECTIVE:

- To develop finite difference and finite volume discretized forms of the CFD equations and formulate explicit & implicit algorithms for solving the Euler Equations & Navier Strokes Equations.

UNIT I GOVERNING DIFFERENTIAL EQUATIONS AND FINITE DIFFERENCE METHOD 10

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II CONDUCTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III CONVECTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Steady One-Dimensional and Two-Dimensional Convection – diffusion, Unsteady one-dimensional convection – diffusion, Unsteady two-dimensional convection – Diffusion.

UNIT IV INCOMPRESSIBLE FLUID FLOW BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE, Computation of Boundary layer flow - Finite difference approach.

UNIT V FINITE ELEMENT METHOD AND TURBULENCE MODELS 5

Introduction to finite element method – solution of steady heat conduction by FEM. Algebraic Models – One equation model, k – ε models - Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes – Prediction of flow in a sudden pipe contraction and pipe.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will demonstrate an ability to recognize the type of fluid flow that is occurring in a particular physical system and to use the appropriate model equations to investigate the flow.
- The student will gain the confidence to simplify a real fluid-flow system into a simplified model problem, and select the proper governing equations involved in the system
- The student will analyze and interpret data obtained from the numerical solution of fluid flow problems.

TEXT BOOKS:

1. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 2003.
2. Ghoshdasdidar, P.S.,“Computer Simulation of flow and heat transfer” Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar “Numerical heat transfer fluid flow”, Hemisphere Publishing Corporation, 1980.

REFERENCES:

1. Versteeg and Malalasekera, N, “An Introduction to computational Fluid Dynamics The Finite volume Method,” Pearson Education, Ltd., 2007.
2. Taylor, C and Hughes, J.B. “Finite Element Programming of the Navier-Stokes Equation”, Pineridge Press Limited, U.K., 1981.
3. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., “Computational fluid Mechanics and Heat Transfer “ Hemisphere Publishing Corporation, New York, USA, 2012.
4. Fletcher, C.A.J. “Computational Techniques for Fluid Dynamics 1” Fundamental and General Techniques, Springer – Verlag, 1991.
5. Fletcher, C.A.J. “Computational Techniques for fluid Dynamics 2” Specific Techniques for Different Flow Categories, Springer – Verlag, 1988.
6. Bose, T.K., “Numerical Fluid Dynamics” Narosa Publishing House, 1997.

PTAU7009 FINITE ELEMENT TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to make the students to understand the general steps of finite element methods, FEM formulation, be able to derive equations in finite element methods for 1D, 2D and 3D problems and its application solid mechanics and heat transfer.

UNIT I INTRODUCTION 9

Review of various approximate methods – Raleigh Ritz’s, Galerkin and finite difference methods – Steps in FEM Analysis – Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS 9

Spring Element. Bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions – Use of local and natural coordinates. Computer codes in discrete elements.

UNIT III CONTINUUM ELEMENTS 9

Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector. Computer codes for CST and LST elements.

UNIT IV ISOPARAMETRIC ELEMENTS 9

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector, Gaussian integration

UNIT V FIELD PROBLEM 9

Heat transfer problems, Steady state fin problems, Derivation of element matrices for two dimensional problems, longitudinal and lateral vibration of beams, torsion problems. Computer codes.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students can able to

- Understand and perform engineering analysis of structural members using FEM.
- Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes
- Develop computer codes for FEM Elements.

TEXT BOOKS:

1. Singiresu S. Rao, "The Finite Element Method in Engineering", Fifth Edition, Butterworth Heinemann, 2010.
2. David V Hutton, "Fundamentals of finite element analysis", 1st Edition, McGraw Hill Education, 2004
3. Daryl L Logan, "A First Course in the Finite Element Method", 5th Edition, CL Engineering, 2010

REFERENCES:

1. Reddy J.N., “An Introduction to Finite Element Method”, Third edition, McGraw Hill, 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
4. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, John Wiley and Sons, Inc., 2001.
5. Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – Printice Hall India, Third Edition, 2003.
6. O.C. Zienkiewicz, R.L. Taylor, "The Finite Element Method for Solid and Structural Mechanics", Sixth edition, Elsevier Butterworth-Heinemann, 2005.
7. Roger T Fenner, "Finite Element Methods for Engineers", Imperial College Press, 1996.
8. Saeed Moaveni, "Finite Element Analysis Theory and Application with ANSYS", Third Edition, Prentice Hall , 2007

PTAU7010	HYBRID AND ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVE :

- To understand the basic concept of Hybrid, Electric Vehicles , energy Storage devices and controls.

UNIT I INTRODUCTION TO NEED FOR ALTERNATIVE SYSTEM 9

History of electric and hybrid vehicles. Need of electric and hybrid vehicles – comparative study of diesel, petrol, electric and hybrid vehicles. Limitations of electric vehicles. Specification of different electric and hybrid vehicles.

UNIT II ENERGY STORAGE DEVICES AND FUELL CELLS 9

Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency and ultra-capacitors.

Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III ELECTRIC VEHICLES 9

Electric vehicle layout, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system, safety and challenges in electric vehicles.

UNIT IV HYBRID VEHICLES 9

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, hybrid electric drive train design, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles.

UNIT V PROPULSION MOTORS AND CONTROLLERS 9

Types of electric motors – working principle of AC and DC motors. Characteristic of shunt, series and compound type of DC motors- permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

TOTAL : 45 PERIODS

OUTCOMES

End of the course student would have deep knowledge on

- Basic of hybrid and electric vehicles
- Different energy storage devices
- Concepts of hybrid electric drive train
- Electric motors and controllers

TEXT BOOKS:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained “ John Wiley & Sons,2003
2. Iqbal Husain, “ Electric and Hybrid Vehicles-Design Fundamentals”, CRC Press,2003
3. Mehrdad Ehsani, “ Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press,2005

REFERENCES:

1. Ron HodKinson, “ light Weight Electric/ Hybrid Vehicle Design”, Butterworth Heinemann Publication,2005
2. Lino Guzzella, “ Vehicle Propulsion System” Springer Publications,2005

PTAU7011 HYDRAULIC AND PNEUMATICS SYSTEMS L T P C

3 0 0 3

OBJECTIVE:

- To understand the hydraulic and pneumatic principles, involved and their components as well as its selection.

UNIT I INTRODUCTION TO FLUID POWER 9

Introduction to fluid power control- Hydraulic and pneumatics- Selection criteria, application of fluid power, application of pascal’s law, equation, Transmission and multiplication of force pressure losses- fluids, selection and properties- ISO symbols

UNIT II FLUID POWER DRIVES 9

Fluid power drives- Pumps- working principle and construction details of gear, vane and piston pumps, hydraulic motor, Hydrostatic transmission drives and characteristics - Hydraulic supply Components- Pneumatic power supply- Compressor, air distribution, air motors. Case study related to automotive application.

UNIT III FLUID POWER ELEMENTS 9

Control valves- pressure, flow direction- working principles and construction- Special type valves- cartridge, modular, proportional and servo- Selection and actuation methods. Actuators- Selection and specification, cylinders- mounting, cushioning, pipe fittings- Fluid conditioning elements- Accumulators. Case study related to automotive application.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 9

Design of Hydraulic and Pneumatic circuits for automation, Selection and specification of circuit components, sequencing circuits, cascade and Karnaugh- Veitch map method- Regenerative, speed control, Synchronizing circuits. Case study related to automotive application.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 9

Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming- Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to design a hydraulic system circuit that can be incorporated in an automotive application.
- Students will gain ability to design Pneumatic circuit for an automotive component that meets desired specifications and requirements.

TEXT BOOKS:

1. Anthony Esposito, " Fluid power with applications" , 5th Edition, Pearson Education 2003.
2. Majumdar, " Oil Hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Prinicples and maintenance", Tata McGraw Hill,2004

REFERENCES:

1. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH,2004
2. William W.Reaves, "Technology of Fluid Power", Delmer Publishers,1997
3. Peter Rohner," Fluid Power Logic circuit Design" MacMillion Press Ltd., 1990.
4. Andrew Parr, " Hydraulics & Pneumatics" Jaico Publishing House,2004

PTAU7012 MANUFACTURING OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

OBJECTIVE:

- To study in detail about the modern casting, forging, molding and machining processes followed in automotive components. To enhance the knowledge of the students in the field of non – ferrous materials, emerging metallic and non-metallic materials like polymers, fiber reinforced plastics (FRP), engineering ceramics, metal matrix composites (MMCs) and its manufacturing methods, selection criteria, properties and applications for automotive components.

UNIT I ENGINE COMPONENTS 9

Overview - Material selection and Manufacturing methods for the Engine Components. Engine block – Casting – Conventional and expendable pattern.Cylinder head – Casting, machining and thermal barrier coating. Crank shaft, connecting rod, camshaft – Forging, machining and heat treatment. Piston - Gravity, squeeze, die casting, machining and finishing. Gudgeon Pin - Machining and Finishing, Valve forging, friction welding, machining, thermal barrier coating, heat treatment and surface improvement. Cylinder Liners, Piston ring - Centrifugal, HPDC, LPDC, machining and finishing. Castings Processes for Oil pan and Carburetors. Push Rods, Rocker Arm, Tappets, Spark Plug – Forging, Machining, Finishing and Heat treatment.

UNIT II TRANSMISSION COMPONENTS 9

Overview - Material selection and Manufacturing methods for transmission system. Flywheel - Casting and Machining. Clutch - Friction plate, clutch housing, pressure plate conventional and fine blanking, composite friction lining. Methods of Gear manufacture – Gear hobbing and gear shaping machines - gear generation - gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching. Gearbox - Casting, precision forging, powder metallurgy, heat treatment and finishing. Propeller shaft - Continuous casting, extrusion, dies heat treatment and surface hardening. Axle-Differential – Axle Shaft – Bearing – fasteners-Forging, casting and machining. Leaf and coil spring - Forging and machining, composite leaf spring and wrap forming of coil spring.

UNIT III BODY COMPONENTS 9

Surface treatment – Plastics – Plastics in Automobile vehicles – Processing of plastics - Body Panel - Thermoforming and hydro forming, press forming, stretch forming. Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing. Welding – Resistance welding and other welding processes with the use of Robots in Body weldment. Instrument Panel - Principle of injection molding, injection molding of instrument panel. Bumpers - Molding of bumpers, reinforced reaction injection molding, tooling and tooling. Manufacture of polymer panels.

UNIT IV CHASSIS COMPONENTS 9

Material selection and manufacturing methods for Vehicle Frame Manufacturing, Wheel drum, Brake drum, Brake shoes, wheel rim and wheel housing manufacturing. Steering systems, shock absorbers, dead axle – casting, forging, machining and finishing operation. Heat treatment procedures for chassis components.

UNIT V TYRES AND ADVANCED MATERIALS MANUFACTURING 9

Tire and tube manufacturing, spray painting, powder coating, Prototype Manufacturing - RPT, 3-D Printing, chemical vapour deposition, physical vapour deposition, cryogenic grinding of powders, sealants, sound proof materials, structural adhesives, MMC liners –Selection of materials for Auto components.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Will be able to select an appropriate manufacturing process for particular Automotive Components.
- Have in-depth knowledge of various engineering materials used in automobile engineering and the corresponding manufacturing processes for the same.

TEXT BOOKS:

1. Heldt P M, “High Speed Combustion Engines”, Oxford IBH publishing Co., Calcutta, 1996.
2. Kalpakjian, “Manufacturing Engineering and Technology”, Pearson Education, 2005.

REFERENCES:

1. John A S, “Introduction to Manufacturing Processes”, Tata McGraw-Hill, 2012.
2. Philip F O and JairoMunuz, “Manufacturing Processes and Systems”, John Wiley & Sons, New York, 1998.
3. Degarmo E P, “Materials and process in Manufacturing”, Macmillan Publishing Co, 1997.
4. Kalpakjian, “Manufacturing Processes For Engineering Materials”, Pearson Education, 2009.
5. B.P. Bhardwaj, “The Complete Book on Production of Automobile Components & Allied Products”, NIIR Project Consultancy Services, 2014.

PTAU7013 METROLOGY AND MEASUREMENT SYSTEM L T P C
3 0 0 3

OBJECTIVE:

- To understand the different degree of accuracy obtained from different types of instruments and the process of reducing uncertainties in measurements

UNIT I SCIENCE OF MEASUREMENT 8

Mechanical measurement – direct comparison and indirect comparison – the generalized measurement system – types of input quantities – measurement standards – calibration – uncertainty – systematic and random errors – common types of errors – classifications of errors– zero, Sensors – transducers. Resistive, Capacitive and Inductive Sensors – Static characteristics– Dynamic characteristics of instruments.

UNIT II LINEAR AND ANGULAR MEASUREMENT 8

Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometer, optical flats, limit gauges – Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements:-Sine bar, optical bevel protractor, angle Decker–Taper measurements, coordinate measuring machine (CMM)

UNIT III FORM MEASUREMENT 8

Measurement of screw threads – Thread gauges, floating carriage micrometer – measurement of gears –tooth thickness-constant chord and base tangent method – Gleason gear testing machine – radius measurements – surface finish, straightness, flatness and roundness measurements.

UNIT IV PRESSURE, FORCE AND TORQUE MEASUREMENT 11

Bourdon tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement – potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement – Mc leod gage, Pirani gauge, thermal conductivity type pressure measurement.

Force measuring devices – Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cradle and eddy current dynamometers.

UNIT V MEASUREMENT OF TEMPERATURE AND FLOW 10

Measurement of temperature – liquid in glass thermometer –partial and total immersion thermometers – resistance thermometers – thermistor – thermo electric thermometers – laws of thermocouples – industrial thermocouples and their ranges – pyrometers – optical total radiation and photo electric

Measurement of flow – need for flow metering – orifice plate, venture meter, flow nozzles, pitot tube rotameter – theory and constructional details – magnetic flow meters – hotwire anemometers-turbine flow meter - flouted tube flow meter-ultrasonic flow meter

TOTAL: 45 PERIODS

OUTCOMES:

The Students will

- Be able to demonstrate their knowledge about different measurement method and devices used in industries.
- Have the ability to handle and interpret measurement data, to estimate measurement uncertainties
- Design measuring equipments for the measurement of Pressure Force, temperature and flow.

TEXT BOOKS:

1. Ernest O Doeblin, “Measurement systems”, McGraw Hill Publishers, 2011.
2. R. K . Jain, “Engineering Metrology”, Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. I.C Gupta, “Engineering Metrology”, Danpat Rai Publications, 2004.
2. Beckwith Thomas G, “Mechanical Measurements”, Pearson Education, 2008.

PTAU7014 NOISE, VIBRATION AND HARSHNESS L T P C
3 0 0 3

OBJECTIVE:

- To provide introduction to students the fundamentals of noise and vibration related to generation, transmission, control techniques and the effect of human sensitivity.To enable the students acquaint with principles and fundamentals in NVH instrumentation and signal analysis techniques

UNIT I FUNDAMENTALS OF NOISE, VIBRATION AND HARSHNESS 9

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping.

UNIT II EFFECTS OF NOISE, BLAST, VIBRATION AND SHOCK ON HUMANS 9

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise. Noise limits in India.

UNIT III TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL 9

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise— Diesel and Gasoline Engines, Tire/Road Noise, Aerodynamic Sound Sources in Vehicles, Transmission and Gearbox Noise and Vibration, Brake Noise. Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration, Noise and Vibration in Off-Road Vehicle Interiors.

UNIT IV ACOUSTICAL DESIGN OF MUFFLERS AND SILENCERS 9

Exhaust and Intake Noise in Diesel and Gasoline Engines - Electro-Acoustic Modeling, Transfer Matrix Modeling, Simple Expansion Chamber, Extended Tube Expansion Chamber, Extended Concentric Tube Resonator, Plug Muffler, Multiply Connected Muffler, Absorptive Ducts and Mufflers, Combination Mufflers, Acoustic Source Characteristics of I.C. Engines, Designing for Adequate Insertion Loss, Mufflers for High Pressure Vents and Safety Valves, Design of Muffler Shell and End Plates, Helmholtz Resonators, Active Noise Control in a Duct and Pressure Drop Considerations.

UNIT V NOISE AND VIBRATION TRANSDUCERS ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES. 9

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Identify sources of noise and vibration from an automobile.
- Solve complicated problems in Noise and Vibration.
- Able to design and select the appropriate Muffler/Silencer for the control of tail pipe noise from an IC engine.
- Demonstrate the knowledge of noise, vibration and physiological effects on Humans.
- Exposed to acoustic instrumentation and noise control techniques

TEXT BOOKS:

1. Malcolm J. Crocker "Handbook of Noise and Vibration Control", John Wiley & Sons, Inc., 2007
2. M L Munjal "Noise and Vibration Control" IISc Lecture Notes Series, World Scientific Publishing Co. Ptv. Ltd. 2013

REFERENCES:

1. M L Munjal"Acoustics of Ducts and Mufflers", 2nd Edition, John Wiley & Sons, Chichester, UK, February 2014.
2. David A.Bies and Colin H.Hansen "Engineering Noise Control: Theory and Practice " Spon Press , London . 2009
3. Randall F Barron, "Industrial Noise Control and Acoustics", Marcel Dekker, Inc. 2003
4. Gang Sheng "Vehicle Noise, Vibration and Sound Quality", SAE International, 2012
5. C.Sujatha "Vibration and Acoustics – Measurement and Signal Analysis", 1st Edition, McGraw Hill Education (India) Pvt Ltd, 2009
6. Allan G. Piersol ,Thomas L. Paez "Harris' shock and vibration hand book" , McGraw-Hill , New Delhi, 2010
7. Clarence W. de Silva , "Vibration Monitoring, Testing, and Instrumentation ",CRC Press, 2007
8. Colin H Hansen "Understanding Active Noise Cancellation " , Spon Press , London .2003
9. Matthew Harrison "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles ", Elsevier Butterworth-Heinemann, Burlington, 2004

PTAU7015 OFF HIGHWAY VEHICLES L T P C

3 0 0 3

OBJECTIVE:

- The main objective of this course is to introduce the concept and principle of operation ofspecial vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc. At the end of the course, the students can have a better understanding of the application of the Off Highway Vehicle in the excavation of earth.

UNIT I EARTH MOVING EQUIPMENTS 9

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders, scrappers, hydraulic shovels, Bucket conveyors etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics. Surface Miners – Highwall Miners, Off-Highway Mining Trucks.

UNIT II CONSTRUCTIONAL EQUIPMENTS 9

Layout of Constructional equipments, excavators, Jip Cranes, hoist, motor graders, Mixing machine, concrete ready mixers, drillers, ramming machines for construction of bridges and working principles, Power generators. Loader-mounted and self-propelled snow blower. Articulated Trucks, Asphalt Pavers, Vibratory Compactors, road reclaimers, Graders.

UNIT III FARM EQUIPMENTS 9

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment – Trailers and body tipping mechanism - plowing - paddy plantation machine harvesting machines. Sugarcane harvesting, power trailers. Feller Bunchers, forest machines and forwarders.

UNIT IV INDUSTRIAL APPLICATIONS 9

Constructional features, capacity and stability of jib cranes. Dragliners, Utility vehicles and man-lift chassis, Foundation and oil field drill rigs carriers, Concrete pump carriers, knuckle boom loaders, Material Handlers. forklifts, Pipe layers. Towing vehicles. fork lift trucks, alternative front end equipment (attachments) – Jib arm, shovel bucket, squeeze clamp, boom, fork extensions, barrel forks. Scissors lift trucks. Case studies.

UNIT V MILITARY AND COMBAT VEHICLES 9

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of Main Battle tankers, gun carriers and transport vehicles, bridge builders, communication vehicles.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Know the concept and principle of operation of special vehicles such as bull dozers , ditchers bucket excavators far equipments military vehicles etc
- Have better understanding of the application of the Off Highway Vehicle in the excavation.
- Understand earth moving and constructional equipments
- Learn the basics of power train concepts for special vehicles
- Grasp the maintenance of farm equipments, military and combat vehicles

TEXT BOOKS:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. SAE Handbook Volume III
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.
4. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
5. Peurifoy R.L “Construction Planning, Equipment and Methods”, Tata McGraw-Hill, New Delhi, 2002.
6. Ian Graham, “Off-Road vehicles”, Heinemann Library, 2008
7. Wong J “ Terramechanics and Off-Road Vehicle Engineering”, Butterworth-Heinemann, 2009

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
4. Astokhov, Truck Cranes, MIR Publishers, Moscow.
5. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIRPublishers, 1972.

PTAU7016 PRINCIPLES OF CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVES :

The student should be able to state, explain and illustrate a set of key concepts related to Control Systems qualitatively in the context of an engineering application

UNIT I SYSTEM AND THEIR REPRESENTATION 9

Basic elements in control systems-Open loop and Closed loop system-Feedback characteristics- Effects of feedback-mathematical modeling of physical systems:- mechanical, Thermal, hydraulic and Pneumatic systems-Transfer function- AC and DC servomotor- Block diagram reduction techniques-signal flow graph- control system components – computer simulation.

UNIT II TIME RESPONSE ANALYSIS 9

Time response- Types of test inputs- First and Second order responses- Error coefficient-Generalized error series- Steady state error- Time domain specifications- Problems related to automotive domain- Computer simulation

UNIT III FREQUENCY RESPONSE ANALYSIS 12

Frequency response- Frequency domain specifications-Bode plot-Polar plot- Determination of phase margin and gain margin- Constant M and N circles-Nichols chart- Determination of closed loop responses from open loop response- Problems related to automotive domain Computer simulation.

UNIT IV STABILITY OF CONTROL SYSTEM 6

Concepts of stability- Location of roots in S-plane for stability- Routh Hurwitz criterion- Root locus techniques- Construction-Nyquist stability criterion- Problems related to automotive domain -Computer simulation

UNIT V CONTROL SYSTEM DESIGN 9

PID controllers – Performance criteria- Selection of controller modes-lag, Lead, and lag-Lead networks-Compensator design for desired response using root locus and Bode diagrams-Problems related to automotive domain -Computer simulation

TOTAL: 45 PERIODS

OUTCOMES :

- To understand the methods of representation of system and thier transfer finction models
- To provide adquate knowledge in the time response of systems and steady state error analysis
- To give basic knowledge in obtainig the open loop and closed loop frequency responses of systems
- To understand the concept of stablity of control system and methos of stablity analysis
- To study the three way of designing compensators for a control system

TEXT BOOKS:

1. Gopal, M., " Control System, Prinicples and Design",Tata MCGraw-Hill Pub. Co., 2nd Edition,New Delhi,2006.
2. Nagrath, I.J. and Gopal,M., "Control System Engineering", New Age International(p),4th Edition, Tata McGraw Hill, 2004

REFERENCES:

1. Ogata, K., " Modern Control Engineering", Prentice hall of India Ltd., 4th Edition, New Delhi,2006
2. Dorf Bishop, "Modern Control System",Prentice Hall,2004
3. Kuo, B.C., "Automatic Control System' Prentice Hall of India Ltd., New Delhi,2003

PTAU7017 QUALITY CONTROL AND RELIABILITY L T P C
3 0 0 3

OBJECTIVE:

- Teach the essentiality of Quality Control, sampling and reliability engineering. Study on various types of control charts, six sigma and process capability to help the students understand various quality control techniques. Reliability engineering focuses on the dependability, failure mode analysis, reliability prediction and management of a system.

UNIT I STATISTICAL PROCESS CONTROL 9

Quality control – Definition – Quality Assurance Variation in process – Factors – control charts – variables XR and XÃ, - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 9

Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL and LTPD – Use of standard sampling plans – Sequential sampling plan. Acceptance sampling plan – Acceptance sampling plan for continuous production - CSP-1 plan CSP-2 Plans.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques – Pareto analysis.

UNIT IV RELIABILITY AND ITS PREDICTION 9

Life testing – Failure characteristics – MTBA MTTF – System reliability – OC curve Availability and Maintainability – Reliability Improvement techniques.

UNIT V FAILURE DATA ANALYSIS 9

Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Will be able to select an appropriate SPC and Sampling process for the Quality Control in particularly for manufacturing Automotive Components.

- Have in-depth knowledge of the Reliability and Failure Data Analysis.
- Will be able to design the experiment based on Taguchi methods

TEXT BOOKS:

1. Amita Mitra “Fundamentals of Quality Control and Improvement” Pearson Education, 2002
2. Modares, “Reliability & Risk Analysis” Marcel Decker Inc. 1993.
3. D. C. Montgomery, “Introduction to Statistical Quality Control”, John Wiley & Sons, 3rd Edition

REFERENCES:

1. Bester field D.H., “Quality Control” Prentice Hall, 7th edition 2003
2. Manohar Mahajan, “Statistical Quality Control” Dhanpal Rai & Sons, 2001
3. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publications, 2004.
4. Charles E Ebling, "An Introduction to Reliablity and Maintainability Engineering" Tata Mc Graw Hill, 2000.
5. D. C. Montgomery and G C Runger, “Applied Statistics and Probability for Engineers”, John Wiley & Sons, 4th Edition

PTAU7018 SIMULATION OF IC ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge in simulating IC engine processes. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. At the end of the course the students will have command over simulation of IC engine process.

UNIT I INTRODUCTION TO SIMULATION 9

Introduction to Simulation, Advantages of computer simulation, Classification of engine models. Intake and exhaust flow models – Quasi steady flow -Filling and emptying -Gas dynamic Models. Thermodynamic based in cylinder models. Step by step approach in SI engine simulation. .

UNIT II STOICHIOMETRY AND ADIABATIC FLAME TEMPERATURE 9

Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air, excess air and stoichiometric air required for combustion. Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state.

UNIT III SI ENGINE SIMULATION 9

SI Engine simulation with air as working medium, deviation between actual and ideal cycle. Fuel air cycle analysis - Temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation. SI Engines simulation with progressive combustion. Models for mass burnt fraction.

UNIT IV SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 9

Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

UNIT V CI ENGINE SIMULATION 9

Zero, one and multi zone models for diesel engine combustion. Wiebe's Model, Whitehouse model and Watson model for diesel combustion. Heat release rate and heat transfer models. Equilibrium calculations. Parametric studies on simulated engine performance.

TOTAL : 45 PERIODS

OUTCOMES

- Students will understand the classifications and applications of engine cycle simulation model and grasp the major modeling and simulation methods and the influence of model parameters on engine performance.
- Students will become familiar with the modeling of progressive combustion and gas exchange processes and ability to build up control-oriented simulation model of internal combustion engines
- They will get familiarized with the essential models of engine cycle simulation and theoretical knowledge to control the calculation accuracy and calculation efficiency of engine performance, combustion and emission.

TEXT BOOK

1. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.

REFERENCES

1. John. B. Heywood, 'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.
2. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
3. Ramoss.A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.
4. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986

PTAU7019 TWO AND THREE WHEELER TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To develop the basic knowledge of the students in constructional details of two and Three Wheelers. Dissect the skills of the students in the operating principles.

UNIT I POWER UNIT 9

Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams. Types of scavenging processes, merits and demerits – scavenging efficiency. Scavenging pumps – Rotary valve engine.

UNIT II FUEL AND IGNITION SYSTEM 9

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, and starting system - Kick starter system – Self starter system. Recent technologies.

UNIT III CHASSIS AND SUB – SYSTEMS 9

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices

UNIT IV BRAKES AND WHEELS 9

Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links lay-outs. Brake actuation mechanism. Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tyres and tubes Construction & its Types- vulcanizing methods. Steering column construction, steering geometry for two & three wheelers.

UNIT V TWO & THREE WHEELER CASE STUDY 9

Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Importance of maintenance – general maintenance schedule – Servicing of two and three wheeler – periodic checkups. Recent developments.

TOTAL: 45 PERIODS

OUTCOMES

On successful completion of this course students will be able to:

- Explain the working of two and four stroke engines.
- Illustrate the functioning of clutch and gear box.
- Demonstrate the wheels, tyres, suspensions and braking systems.
- Identify the latest models of two wheelers.
- Define the operations of three wheelers and latest models of three wheelers

TEXT BOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.
2. Marshal Cavandedish, 'Encyclopedia of Motor cycling', New York, 1989
3. Srinivasan.S., 'Motor cycle, Scooter, Mopeds', New century book house, 1988.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai,
3. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
4. Bryaut,R.V., Vespa Maintenance and Repair series.
5. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

PTAU7020 VEHICLE AIR-CONDITIONING L T P C

3 0 0 3

OBJECTIVES :

- The objective of the course is to impart knowledge in the area of pychrometry, refrigerant and to understand the various components of vehicle air conditioning. Also the Servicing and repairing aspects of vehicle air conditioning will be covered.

UNIT I AUTOMOTIVE AIR CONDITIONING FUNDAMENTALS 9

Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems

UNIT II AUTOMOTIVE COOLING AND HEATING SYSTEM 9

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and

pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system

UNIT III AIR-CONDITIONING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS 9

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining drive ability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL 9

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system

UNIT V SYSTEM SERVICING AND TESTING 9

Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service

TOTAL : 45 PERIODS

OUTCOMES:

- Student will understand the fundamental principles and operation of the heating, cooling, ventilation and air-conditioning system.
- Student will able to solve the simple problems related to pychrometry and refrigerant
- Enable the student to understand the operation of the individual components of the A/C
- System, sensors, actuators and electronic control
- Enable the reader to understand the range of techniques that can be used in diagnosing
- faults which affect system performance
- To provide adquate knowledge in safe working practice. understanding the correct procedures for A/C service and repair

TEXT BOOKS:

1. Warren Farnell and James D.Halderman, Automotive Heating, Ventilation, and Air Conditioning systems, Classroom Manual, Pearson Prentice Hall,2004
2. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.

REFERENCES:

1. Mitchell Information Services, Inc., Mitchell Automatic Heating and Air Conditioning Systems, Prentice Hall Inc., 1989.
2. Paul Weisler, Automotive Air Conditioning, Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
4. Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.

PTAU7021 VEHICLE MAINTENANCE L T P C
3 0 0 3

OBJECTIVE :

- To impart the knowledge on basics of vehicle maintenance and maintenance of engine subsystems and drive line components.

UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS 9

Maintenance – Need, importance, classification of maintenance, basic problem diagnosis. Automotive service procedures – workshop operations – Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments.

UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE 9

General Engine service- Dismantling of Engine components- Engine repair- Service of basic engine sub systems- cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis-servicing emission controls

UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE 9

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT IV STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE 9

Maintenance and Service of steering system-Inspection, Maintenance and Service of brake system- Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers-Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection,

UNIT V AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 9

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

TOTAL : 45 PERIODS

OUTCOMES

End of the course student would have deep knowledge on

- Importants of Vehicle maintenance
- Service procedure of engine and subsystems
- Service procedure of drive line
- Maintenance of electrical and air conditioning system

TEXT BOOKS

1. William H Crouse and Donald L Anglin “Automotive Mechanics” Tenth Edition, Mc Graw Hill Publications, 2007
2. Ed May, Automotive Mechanics Volume One , Mc Graw Hill Publications, 2003
3. Ed May, Automotive Mechanics Volume Two , Mc Graw Hill Publications, 2003

REFERENCES

1. Bosch Automotive Handbook, Sixth Edition,2004
2. Vehicle Service Manuals of manufacturers

PTAU7022 VEHICLE MULTIPLEXING L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to impart knowledge in the areas of vehicle networking, various vehicle networking standards and multiplexing buses

UNIT I INTRODUCTION TO VEHICLE NETWORKING CONCEPTS 9

Historical Perspective- Multiplexing Paradox- Vehicle multiplexing comparison to industry- Why multiplexing – Popularity of multiplexing- SAE Classification- Intra Module Versus Intermodule communication- Examples of Vehicle Nodes – Terminology like : open architecture , Broad cast, Peer to peer, Baud rate versus Bit rate, protocol Synchronous and asynchronous protocol- On board Diagnostics- Encoding- Error Handling- Media Characteristics etc.

UNIT II VARIOUS MULTIPLEXING LEVEL 9

The vehicle Level- Topologies- Network Design issues- Development Tools- Service tools- Vehicle Level Testing- The Electronic Control Level- Integrated Control- Unexpected message delays- message synchronization- local loss of power and ground- Integrated circuit level- Partitioning – General digital tradeoffs- Digital CAN implementation- Electromagnetic compatibility

UNIT III MULTIPLEXING STANDARDS 9

ISO standards- SAE international standards- Class A protocols- Class B protocols- Class C protocols- Diagnostic Protocols- Air Bag Protocols- Wireless Protocols- Data Link Usage- Future Trends

UNIT IV CAN: FROM CONCEPT TO REALITY 9

The CAN bus: general-CAN: its protocol, its properties, its novel features-The CAN physical layer-Medium, implementation and physical layers in CAN-Components, applications and tools for CAN-Event-triggered and time-triggered aspects-TTCAN – Time-triggered communication on CAN-Towards high-speed, X-by-Wire and redundant systems

UNIT V NEW MULTIPLEXED BUS CONCEPTS 9

LIN – Local Interconnect Network-Think ‘Bus’, think ‘Fail-safe SBC’, ‘Gateways’ -Safe-by-Wire-Audio-video buses

TOTAL: 45 PERIODS

OUTCOMES :

- Students will acquire knowledge in multiplexing terminology and Standards relevant to vehicle
- Student can able to understand the current state of the CAN protocol, all the possible subdivisions of the physical layers and everything relating to conformity problems.
- Student can able to know the importance of various new multiplexed bus concepts

TEXT BOOKS:

1. Vehicle Multiplex Communication by Christopher Albert Lupini , SAE International ISBN 0-7680-1218-X, 2004
2. Multiplexed Networks for Embedded System by Dominique Paret, John Wiley & sons, 2007

PTAU7023 VIRTUAL INSTRUMENTATION IN AUTOMOBILE ENGINEERING **L T P C 3 0 0 3**

OBJECTIVE :

- To learn and understand the programming, data acquistion hardware and implementing small automotive related projects in virtual instrumention.

UNIT I INTRODUCTION **9**

Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation- VI programming techniques- VI, sub VI, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

UNIT II DATA ACQUISITION IN VI **9**

A/D and D/A Converters, plug-in Analog input / Output cards- Digital Input and Output cards, Organization of the DAQ VI system- Opto Isolation- Performing analog input and analog output- Scanning multiple analog channels- issues involved in selection of data acquisition cards- Data acquisition modules with serial communication- Design of digital voltmeter with transducer input- Timers and Counters.

UNIT III COMMUNICATION NETWORKED MODULES **9**

Introduction to PC buses-Local buses:-ISA,PCI,RS232,RS422 and RS 485- Interface buses:-USB,PCMCIA,VXI,SCXI and PXI – Instrumentation Buses:- Modbus and GPIB- Networked buses-ISO/OSI reference model, Ethernet and TCP/IP Protocols.

UNIT IV REAL TIME CONTROL IN VI **9**

Design of ON/OFF controller and proportional controller for a mathematically described processes using VI software- Modeling and basic control of level and Reactor Processes- Case Studies on development of HMI, SCADA in VI.

UNIT V AUTOMOTIVE APPLICATIONS **9**

PC based digital storage oscilloscope- Sensor technology and signal processing- virtual laboratory- spectrum analyzer- wave form generator- Data visualization and multiple locations:-Distributed monitoring and control-Vision and motion control. Case study related to automotive applications

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”. Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., “Labview Advanced programming Techniques”, CRC Press, 2nd Edition, 2007.
3. Gupta, S. and Gupta J. P., “PC Interfacing for Data Acquisition and Process Control”, 2nd Edition, Instrument Society of America, 1994.

REFERENCES:

1. Jamal, R. and Picklik, H., “Labview-Applications and Solutions “, National Instrument Release
2. Johnson, G.,” Labview Graphical programming “ , McGraw-Hill, Newyork,1997.
3. Wells, L.K and Travis, J., “ Labview for Everyone”, Prentice Hall, New Jersey, 1997
4. Buchanan, W., ”Computer Busses ”, CRC Press, 2000

PTPR7001 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C
4 0 0 4

OBJECTIVE:

- To introduce the various quantitative techniques and optimization techniques and to make the students apply these techniques for modeling and solving many engineering situations in general and manufacturing situations in particular.

UNIT I LINEAR PROGRAMMING 12

Problem formulation - Graphical method – simplex method – Special cases – transportation and assignment method – applications**.**

UNIT II REPLACEMENT MODELS AND GAME THEORY 12

Basic replacement model – individual and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications of LP in game theory – applications.

UNIT III QUEUING MODELS AND SIMULATION 12

Elements of queue – queue discipline – Poisson arrival and exponential service – queue length – waiting time – steady state conditions – applications – concept of simulation – Monte Carlo method – applications.

UNIT IV FORECASTING, SEQUENCING AND LINE BALANCING 12

Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules - sequencing – methods of sequencing – Johnson's rule – Heuristic approach, line balancing – applications.

UNIT V PROJECT NETWORK ANALYSIS AND DECISION TREE ANALYSIS 12

Network – CPM/PERT – Project time estimation – critical path – crashing of network, Decision tree analysis – applications

TOTAL: 60 PERIODS

OUTCOME:

- The students shall able to select and apply techniques for typical engineering and industrial situations.

TEXT BOOKS:

1. Panneerselvam R., "Operation Research", Prentice Hall of India, 2008.
2. Hamdy A.Taha, "Operations Research – An Introduction", Prentice Hall of India, 8th edition 2008.

REFERENCES:

1. Guptha. P.K. and Man-Mohan, "Problems in Operations Research", Sultan chand and Sons, 2014.
2. Monks. J.G, "Operations Management theory and Practice", McGraw Hill, 2nd edition 1996.
3. Ravindran, Philips and Sojberg, "Operations Research Principles and Practice", John Wiley and Sons, Singapore, 2nd edition,2007.
4. Sharma J.K., "Operations Research Theory and Applications", Macmillan India Ltd., 4th edition, 2009.

PTGE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,
- Disaster damage assessment and management.

TEXT BOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13:978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES L T P C
3 0 0 3

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES 3

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY 12

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and chernobyl as case studies.

UNIT V GLOBAL ISSUES 12

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES

- Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford Press , 2000
5. R.Subramanian , “Professional Ethics “,Oxford University Press ,Reprint ,2015.

PTGE7073 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., “Human Rights under International law and Indian Laws”, Central Law Agency, Allahabad, 2014.
2. Chandra U., “Human Rights”, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PTGE7074 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning-- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma Process Capability– Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”,Prentice Hall (India) Pvt. Ltd., 2006.

PTGE7075 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C

3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING (PART TIME)
REGULATIONS – 2017

Program Educational Objectives:

Bachelor of Electrical and Electronics Engineering curriculum is designed to prepare the graduates having attitude and knowledge to

1. have successful professional and technical career
2. have strong foundation in basic sciences, mathematics and computational platforms
3. have knowledge on the theory and practices in the field of electrical power engineering and allied areas
4. engross in life-long learning to keep themselves abreast of new developments
5. practice and inspire high ethical values and technical standards

Program Outcome:

a) Ability to apply knowledge of mathematics, sciences and engineering
b) Ability to understand and apply basic theorems and postulate in circuit, field and control theories
c) Ability to identify, formulate and solve electrical power engineering problems
d) Ability to analyse and apply electronics in the field of electrical power apparatus and systems
e) Ability to understand and apply computational platforms and software tools for engineering applications
f) Ability to understand ethical and professional responsibilities
g) Ability to communicate effectively and work in interdisciplinary groups
h) Ability to review, comprehend and report technological development

PEO \ PO	a	b	c	d	e	f	g	h
1						√	√	√
2	√		√		√			
3		√	√	√				
4						√	√	√
5						√	√	

MAPPING – UG- ELECTRICAL AND ELECTRONICS ENGINEERING (PART TIME)

			PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h
YEAR 1	SEM 1	Applied Mathematics	√							
		Environmental Science and Engineering	√							
		Electric Circuit Analysis	√	√	√	√				
		Electron Devices and Circuits	√		√	√				
		Computer Practice Laboratory	√				√			
	SEM 2	Digital Systems and Microcontrollers	√			√	√		√	
		Electromagnetic Theory	√	√		√				
		Network Analysis and Synthesis	√	√						
		Power Plant Engineering	√						√	
		Integrated circuits and Microcontrollers Laboratory	√			√	√		√	

YEAR 2	**SEM 3**	Control Systems	√	√	√	√				
		Electrical Machines I	√	√	√	√				
		Linear Integrated Circuits	√	√		√				
		Transmission and Distribution	√	√	√	√				
		Control and Instrumentation Laboratory	√	√	√		√			
	SEM 4	Electrical Machines II	√	√	√	√				
		Power Electronics	√		√	√				√
		Power System Analysis	√	√	√					
		Elective I								
		Electrical Machines Laboratory	√	√	√	√				

YEAR 3	**SEM 5**	High Voltage Engineering	√		√	√				
		Power System Operation and Control	√	√	√					
		Protection and Switchgear	√	√	√					
		Elective II								
		Power Electronics and Drives Laboratory	√		√	√				√
	SEM 6	Design of Electrical Apparatus	√		√	√				√
		Solid state Drives	√		√	√				√
		Elective III								
		Elective IV								
		Power System Simulation Laboratory	√	√	√	√	√			

YEAR 4	**SEM 7**	Elective V								
		Elective VI								
		Elective VII								
		Project Work					√		√	√

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2017
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING (PART TIME)
CURRICULA AND SYLLABI I - VII SEMESTERS

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTGE7153	Environmental Science and Engineering	3	0	0	3
3.	PTEE7101	Electric Circuit Analysis	3	0	0	3
4.	PTEC7104	Electron Devices and Circuits	3	0	0	3
PRACTICALS						
5.	PTGE7111	Computer Practices Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7201	Digital Systems and Microcontrollers	3	0	0	3
2.	PTEE7202	Electromagnetic Theory	3	0	0	3
3.	PTEE7203	Network Analysis and Synthesis	3	0	0	3
4.	PTME7751	Power Plant Engineering	3	0	0	3
PRACTICALS						
5.	PTEE7211	Integrated circuits and Microcontrollers Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7301	Control Systems	3	0	0	3
2.	PTEE7302	Electrical Machines I	3	0	0	3
3.	PTEE7303	Linear Integrated Circuits	3	0	0	3
4.	PTEE7304	Transmission and Distribution	3	0	0	3
PRACTICALS						
5.	PTEE7311	Control and instrumentation Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7401	Electrical Machines II	3	0	0	3
2.	PTEE7402	Power Electronics	3	0	0	3
3.	PTEE7403	Power System Analysis	3	0	0	3
4.		Elective I	3	0	0	3
PRACTICALS						
5.	PTEE7411	Electrical Machines Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7501	High Voltage Engineering	3	0	0	3
2.	PTEE7502	Power System Operation and Control	3	0	0	3
3.	PTEE7503	Protection and Switch gear	3	0	0	3
4.		Elective II	3	0	0	3
PRACTICALS						
5.	PTEE7511	Power Electronics and Drives Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEE7601	Design of Electrical Apparatus	3	0	0	3
2.	PTEE7602	Solid State Drives	3	0	0	3
3.		Elective III	3	0	0	3
4.		Elective IV	3	0	0	3
PRACTICALS						
5.	PTEE7611	Power system simulation Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.		Elective V	3	0	0	3
2.		Elective VI	3	0	0	3
3.		Elective VII	3	0	0	3
PRACTICALS						
4.	PTEE7711	Project work	0	0	9	6
		TOTAL	**9**	**0**	**9**	**15**

TOTAL NO. OF CREDITS: 99

ELECTIVES

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTMA7001	Discrete Mathematics	3	0	0	3
2.	PTMA7071	Probability and Statistics	3	0	0	3
3.	PTGE7071	Disaster Management	3	0	0	3
4.	PTGE7072	Engineering Ethics and Human Values	3	0	0	3
5.	PTGE7073	Human Rights	3	0	0	3
6.	PTGE7074	Total Quality Management	3	0	0	3
7.	PTGE7075	Intellectual Property Rights	3	0	0	3
8.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
9.	PTMG7001	Managerial Economics and Financial Accounting	3	0	0	3
10.	PTMG7751	Principles of management	3	0	0	3
11.	PTEE7001	Adaptive Control	3	0	0	3
12.	PTEE7002	Advanced Control Systems	3	0	0	3
13.	PTEE7003	Analysis of Electrical Machines	3	0	0	3
14.	PTEE7004	Computer Aided Design of Electrical Apparatus	3	0	0	3
15.	PTEE7005	Data Structures and Algorithms	3	0	0	3
16.	PTEE7006	Digital Signal Processing	3	0	0	3
17.	PTEE7007	EHV Power Transmission	3	0	0	3
18.	PTEE7008	Electrical Measurements and Instrumentation	3	0	0	3
19.	PTEE7009	Embedded Automation Systems	3	0	0	3
20.	PTEE7010	Embedded System Design	3	0	0	3
21.	PTEE7011	Energy Management and Auditing	3	0	0	3
22.	PTEE7012	Flexible AC Transmission Systems	3	0	0	3
23.	PTEE7013	Fundamentals of Computer Architecture	3	0	0	3
24.	PTEE7014	Fundamentals of Object Oriented Programming	3	0	0	3
25.	PTEE7015	High Voltage Direct Current Transmission	3	0	0	3
26.	PTEE7016	Industrial Power System Analysis and Design	3	0	0	3
27.	PTEE7017	Medical Instrumentation	3	0	0	3
28.	PTEE7018	Micro Electro Mechanical Systems	3	0	0	3
29.	PTEE7019	Nano Technology	3	0	0	3
30.	PTEE7020	Operational Research	3	0	0	3
31.	PTEE7021	Power Electronics for Renewable Energy Systems	3	0	0	3
32.	PTEE7022	Power Quality	3	0	0	3
33.	PTEE7023	Restructured Power Systems	3	0	0	3
34.	PTEE7024	Smart Grid	3	0	0	3
35.	PTEE7025	Soft Computing Techniques	3	0	0	3
36.	PTEE7026	Special Electrical Machines	3	0	0	3
37.	PTEE7027	VLSI Design and Architecture	3	0	0	3
38.	PTCS7071	Operating Systems				
39.	PTEI7651	Industrial Data Communication	3	0	0	3

PTMA7151 **APPLIED MATHEMATICS** **L T P C**
(Common to all branches of B.E / B.Tech (PT) Programmes) **3 0 0 3**

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES **9**

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION **9**

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **9**

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9**

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUT COMES :

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTGE7153 ENVIRONMENTAL SCIENCE AND ENGINEERING LT P C
3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth"s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi,2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

PTEE7101	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To make the students to understand the concept of circuit elements, lumped circuits, waveforms, circuit laws and network reduction techniques. To analyze the, series and parallel AC circuits, and to solve problems in three phase circuits.

UNIT I INTRODUCTION 9

Types of sources; relation between voltage and current in network elements; concept of active, passive, linear, nonlinear, unilateral, bilateral, lumped, distributed elements; Kirchhoff's laws and their application to node and mesh analysis of networks. Concept of tree, branch, cotree, link, loop, and cutset. Problems involving D.C. circuits only.

UNIT II NETWORK REDUCTION TECHNIQUES AND NETWORK THEOREMS 9

Series parallel circuits; star , delta and reverse transformation; superposition, reciprocity, compensation, Thevenin's, Norton's, Millman's and maximum power transfer theorems; principle of duality. Problems involving D.C. circuits only.

UNIT III AC CIRCUITS 9

Basic definitions; phasors and complex representation; RMS,Average value, form factor peak factor- AC signals ;solution of RLC networks; power and energy relations; application of Kirchhoff's laws, Thevenin's, Norton's, Maximum power transfer theorems to A.C. circuits.

UNIT IV RESONANCE AND APPLICATIONS 9

Resonant circuits-series, parallel, series-parallel circuits-effect of variation of Q on resonance. Relations between circuit parameters- Q, resonant frequency and bandwidth. Inductively coupled circuits-single tuned and double tuned circuits - bandwidth and frequency response.

UNIT V THREE PHASE CIRCUITS 9

Three phase balanced / unbalanced voltage sources phase sequence – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 45 PERIODS

COURSE OUTCOMES

- Learners will be able to analyse the electric circuits with DC and AC excitation by applying various circuit laws.

TEXT BOOKS

1. M Nahvi I J A Edminster "Electric Circuits"; *Schaum's outline series* , Tata Mcgraw Hill companies, 4th Edition, 2009

2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Fifth Edition, McGraw Hill, 2013.

3. David A Bell ," Electric circuits ", Oxford University Press, 2011

REFERENCES

1. R.Jagatheesan "Electric Circuit Analysis", Tata Mcgraw Hill ,2014

2. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw Hill publishers, 6th edition, New Delhi, 2002.

3. Sudhakar. A, Shyammohan. S.P "Circuits and Networks-Analysis and Synthesis"; Tata McGraw Hill publishers, 2006.

PTEC7104 ELECTRON DEVICES AND CIRCUITS L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode-characteristics-Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis –

FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Explain the structure of basic electronic devices.
- Design applications using basic *electronic devices

TEXT BOOKS:

1. David A. Bell ,"Electronic devices and circuits", Prentice Hall of India, 2004.
2. Sedra and smith, "Microelectronic circuits "Oxford University Press, 2004.

REFERENCES:

1. Rashid, "Micro electronic circuits" Thomson publications, 1999.
2. Floyd, "Electron devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGrawHill, 3rd Edition,2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application ofAnalog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004

PTGE7111 COMPUTER PRACTICES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

LIST OF EXPERIMENT

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function

10. Program using structures and unions.

TOTAL : 60 PERIODS

OUTCOMES

At the end of the course, the student should be able to:

- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

30 Systems with C compiler

PTEE7201 DIGITAL SYSTEMS AND MICROCONTROLLERS LT P C
3 0 0 3

OBJECTIVES:

- To introduce the fundamentals of Computational Digital System Technologies
- To introduce digital simulation techniques for development of application oriented logic circuits.
- To study the Architecture, addressing modes & instruction set of 8085 and 8051 and to develop skills in writing simple programs.
- To introduce commonly used peripheral interfacing ICs.
- To study and understand the typical applications of micro-controllers

UNIT I DIGITAL LOGIC FAMILIES 9

Introduction to Digital Logic for Design of adder, subtractor, comparators, code converters, encoders, decoders –Introduction through Comparison to Logic families: RTL ad DTL circuits, TTL, ECL, CMOS family- Basics of Programmable Architectures- PROM, PLA, PLD, FPGA.

UNIT II 8085 PROCESSOR AND ITS PERIPHERAL INTERFACING 9

8085: Functional block diagram –- Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupts - Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8254 Timer/ Counter.

UNIT III PROGRAMMING FUNCTIONALS IN PROCESSORS 9

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions, stack.

UNIT IV MICRO CONTROLLER 8051 9

Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer – I/O ports – Serial communication, Data Transfer, I/O instructions .

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises - key board and display interface – Manipulation, Control of Temperature control system - stepper motor control.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyse, comprehend, design and simulate microprocessor and microcontroller based systems used for control and monitoring.

TEXT BOOKS:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Penram International (P) ltd., Mumbai, 5th edition, 2008.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, 2007.

REFERENCES:

1. N.Senthil Kumar, M.Saravana, S.Jeevananthan, 'Microprocessors and Microcontrollers', Fifth Edition, Oxford Higher Education, 2013.
2. Douglas V. Hall, 'Micro-processors and interfacing' Tata McGraw Hill, 2nd Edition, New Delhi, 2009
3. Kenneth Ayala, 'The 8051Microcontroller', Thomson, 2005.
4. Krishna Kant, 'Microprocessors and Microcontrollers', Prentice Hall of India Pvt. Ltd. 2007.
5. M. Morris Mano, 'Digital Design', Pearson Education, 2008.

PTEE7202 ELECTROMAGNETIC THEORY LT P C
3 0 0 3

OBJECTIVES:

To impart knowledge on the concepts and the computation of Electro-magnetic fields which is essential for understanding the working principle, design and analysis of Electrical machines and Systems.

UNIT I ELECTROSTATICS I 9

Sources and effects of electromagnetic fields, Vector fields, Vector Calculus- Gradient, Divergence, Curl – theorems and applications. Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS II 9

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectric -Dielectric polarization - Dielectric strength - Electric fields in multiple dielectrics – Boundary conditions, Capacitance, Energy density, Poisson's and Laplace's equations – solutions by Direct Integration method, Applications.

UNIT III MAGNETOSTATICS 9

Lorentz force, magnetic field intensity (**H**) – Biot– Savart's Law - Ampere's Circuit Law – **H** due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (**B**) – **B** in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, Scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 9

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Time varying potential – Relation between field theory and circuit theory , Applications

UNIT V ELECTROMAGNETIC WAVES 9

Electromagnetic Wave Generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossless and lossy dielectrics, conductors-skin depth , Poynting vector , Plane wave reflection and refraction – Standing Wave , Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand Electro-magnetic field theory and apply them for modelling and analysis of electrical equipment.

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4th Edition, Oxford University Press Inc. First India edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009

REFERENCES:

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010
2. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory fundamentals", Cambridge University Press; Second Revised Edition, 2009.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
5. B N Basu,' Electromagnetic essentials' , Universities Press, 2015

PTEE7203 NETWORK ANALYSIS AND SYNTHESIS LT P C
3 0 0 3

OBJECTIVES

- To analyse the relationship between various two port parameters, ladder and lattice networks.
- To analyse the transients in electrical networks with DC and AC excitation
- To synthesise RL, RC & RLC networks by Foster and Cauer form
- To design different types of passive filters.

UNIT I INTRODUCTION TO GRAPH THEORY 9

Linear Graphs in Electrical Networks, Basic Definitions, Incidence, Loop and cut-set matrices, Fundamental Loop and Fundamental Cut-Set Matrices, Graph Theoretic version of KCL and KVL, Loop Impedance and Node Admittance Matrices, Duality in Electrical Networks.

UNIT II TWO PORT NETWORK 9

Network functions - Poles and Zeros of network functions - Complex frequency - Two port parameters Z,Y,H and ABCD - Scaling network functions -T and π equivalent circuits - Bridged

networks - Analysis of ladder and lattice networks - Coupled circuits as two port network - Tuned circuits.

UNIT III TRANSIENT RESPONSE OF RLC CIRCUITS 9

Transient response of RL,RC,RLC, circuit for DC input and AC input with sinusoidal excitation.

UNIT IV TRANSFER FUNCTION SYNTHESIS 9

Properties of LC,RL,RC driving point functions, Synthesis of driving point LC,RC and RL functions - Foster and Cauer forms- Synthesis of transfer admittance, transfer impedance with a one ohm termination - Synthesis of constant-resistance network.

UNIT V DESIGN OF FILTER 9

Design of filters -Low pass filters, high pass filters, band pass filters, band reject filters, Butterworth filters, m-derived filters, constant k-filters

TOTAL: 45 PERIODS

OUTCOMES

- Students can have the ability to analyse various electrical networks in steady & transient states and also equipped to design various types of filters.

TEXT BOOKS

1. Franklin F.Kuo**,** "Network Analysis and Synthesis (5th Edition ,2012)" Wiley International;2010
2. Andreas Antoniou," Digital filters (Analysis, Design and Application)", McGraw-Hill; 2nd edition (May 15, 2000)

REFERENCES

1. M.E.Van Valkenberg, "Introduction to Modern Network Synthesis", *Wiley Eastern;.*
2. Umesh Sinha "Network Analysis and Synthesis"Satya Prakashan Publishers , 4th Edition 2013
3. David A Bell,"Electric Circuits Oxford Press, ", (7thEdition, 2011).

PTME7751 POWER PLANT ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To understand the working of power plants and analyse their performance.
- To learn the economics of power generation.

UNIT I HYDRO POWER PLANTS 9

Energy scenario – Global and National. Essential elements and classification of hydro power plants. Typical Layout and associated components. Selection of turbines. Pumped storage plants.

UNIT II COAL, OIL AND GAS TURBINE POWER PLANTS 9

Cycle analysis - Layout of modern coal based power plant. Super Critical Boilers - FBC Boilers. Subsystems – Water and Steam, Fuel and ash handling, Air and Gas, Draught system. Diesel and Gas Turbine power plants- Layout and Functioning. Environmental impact and Control.

UNIT III NUCLEAR POWER PLANTS 9

Layout and subsystems. Fuels and Nuclear reactions. Boiling Water Reactor, Pressurized Water Reactor, Fast Breeder Reactor, Gas Cooled and Liquid Metal Cooled Reactors – working and Comparison. Safety measures. Environmental aspects.

UNIT IV RENEWABLE ENERGY POWER PLANTS 9

Solar power plants – Photovoltaic and Thermal. Wind power plants – Vertical and Horizontal axes Wind Turbines. Biomass power plants – Gasification and combustion. Tidal and Ocean Thermal Energy plants. Geothermal plants. Fuel cell – Types. Hybrid power plants.

UNIT V ECONOMICS OF POWER GENERATION 9

Load and load duration curves. Electricity billing – costing of electrical energy – Tariff structures. Economics of power plant – Fixed and variable cost. Payback period. Net Present Value, Internal Rate of Return. Emission calculation and carbon credit.

TOTAL:45 PERIODS

OUTCOME:

Upon completion of this course the students will be able to:

- Understand the working of different power plants
- Arrive at cost of power generation, electricity billing and rate of return on power plant investments

TEXT BOOKS:

1. P.K.Nag, “Power Plant Engineering”, Tata McGraw Hill, 2014.
2. Paul Breeze, “Power Generation Technologies”, Elsevier Ltd., 2014.

REFERENCES:

1. Black and Veatch, “Power Plant Engineering”, Indian edition, CBS Publishers and Distributors, New Delhi, 1998.
2. M.M.El.Wakil, “Power Plant Technology”, Tata McGraw Hill, 2010.
3. K.Rajput, “Power Plant Engineering”, Laxmi Publications, 2005.
4. Janet Wood, “Nuclear Power”, The Institution of Engineering and Technology, 2007.
5. James Momoh, Smart Grids - Fundamentals of Design and analysis, Wiley Press, 2012.

PTEE7211	INTEGRATED CIRCUITS AND MICROCONTROLLER LABORATORY	L T P C 0 0 4 2

OBJECTIVES:

- To develop an in-depth understanding of the operation of microprocessors and microcontrollers
- To program microprocessor/microcontroller using assembly languages
- To understand the standard microprocessor/ microcontroller interfaces
  To design combinational logic circuits using digital IC’s
  To analyse and design various applications of Op-Amp

LIST OF EXPERIMENTS

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division.

2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.

3. Interface Experiments:

   - A/D Interfacing.
   - D/A Interfacing.
   - Traffic light controller.

4. Interface Experiments:

   - Simple experiments using 8251, 8279, 8254.

5. Demonstration of basic instructions with 8051 Micro controller execution, including:

   1 Conditional jumps, looping

   2 Calling subroutines.

   3 Stack parameter testing

6. Parallel port programming with 8051 using port 1 facility:

   1 Stepper motor and D / A converter.

7. Implementation of Boolean Functions, Adder/ Subtractor circuits.

8. Combination Logic: Adder, Subtractor, Code converters, Encoder and Decoder.

9. Sequential Logic: Study of Flip-Flop, Counters (synchronous and asynchronous), Shift Registers

10. Op-Amp Linear Application: Comparator, Differentiator, Integrator, Adder, Subtractor. Op-amp, Non Linear Application: Clipper, Clamper, Peak detector,

11. Timer IC application, astable multi-vibrator and VCO circuit.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

1. 8085 – Microprocessor student trainer kit – 15 Nos
2. 8051 – Micro controller student trainer kit – 15 Nos
3. DAC, ADC interface cards – 5 Nos
4. Traffic light controller interface board – 5 Nos
5. Stepper motor drive interface – 5 Sets
6. Keypad – display interface card – 5 Nos
7. Oscilloscope (CRO) – 5 Nos
8. Regulated Power supply ± 12V, 0.5A and +5V, 2A along with Bread – board and analog digital IC, as per the above list – 5 sets

TOTAL:60 PERIODS

OUTCOMES:

The students are able to

- Understand and apply the fundamentals of assembly level programming of microprocessors/ microcontrollers
- Work with standard microprocessor/ microcontroller interfaces
  Implement real-time systems
- Design and conduct experiments using digital IC's and Op-Amp

PTEE7301 CONTROL SYSTEMS LT P C
3 0 0 3

OBJECTIVES:

To emphasize the importance of control and empower the students with basic concepts on modelling, analysis and design of control systems restricted to linear continuous time system. The specific objectives of each unit are

- To introduce the classical way of modelling systems, commonly used control components and their mathematical models from physical laws
- To introduce the time domain analysis of transfer function models and understand the concepts of poles, zeros and movement of poles under feedback
- To introduce the various graphical methods available to analyse and asses systems in frequency domain
- To impart knowledge in the modern state variable approach, closed form solution methods and analysing system properties
- To educate on drawing of specification, choosing of control structures and methods of designing the controllers

UNIT I INTRODUCTION 9

Control system - Basic components - Open and closed Loop - Effect of feedback - System representations - Transfer functions of single input & single output and multivariable systems – Block diagrams – Signal flow graphs – Gain formula – Modelling of control components – Mechanical and electrical systems

UNIT II TRANSFER FUNCTION MODEL AND ANALYSIS 9

Standard test signals- steady state error and error constants - Time response – Damping ratio - Natural frequency – Effects of adding poles and zeros – Dominant poles - Stability – Routh Hurwitz criterion – Root locus plots of typical systems – Root locus analysis

UNIT III FREQUENCY DOMAIN ANALYSIS 9

Frequency response – Resonant peak – Bandwidth – Effect of adding poles and zeros – Magnitude and phase plots of typical systems – Nyquist stability criterion – Gain margin – Phase margin - Bode plot - Polar Plot - M & N Circles.

UNIT IV STATE VARIABLE MODEL AND ANALYSIS 9

State variable formulation – Non-uniqueness – Solution - State transition matrix – Eigen values – Eigen vectors – Stability - Controllability – Observability

UNIT V DESIGN OF CONTROL SYSTEMS 9

Design Specification – Controller configurations – PID controller - Design using reaction curve and Ziegler-Nichols technique – Compensation schemes - Effect of providing Lag, Lead and Lag- Lead compensation on system performance and design. State variable design

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyse systems using transfer function and state space models
- Ability to design controllers and compensators using conventional techniques

TEXTBOOKS

1. Benjamin C. Kuo, Automatic Control Systems, PHI Learning Private Ltd, 2010.
2. J. Nagrath and M. Gopal, Control Systems Engineering, Tata McGraw-Hill Education Private Limited, Reprint, 2010.

REFERENCES

1. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, Pearson Education, Third Impression, 2009.
2. Control System Dynamics" by Robert Clark, Cambridge University Press, 1996 USA. ISBN: 0-521-47239-3.
3. John J. D'Azzo, Constantine H. Houpis and Stuart N. Sheldon, Linear Control System Analysis and Design with Matlab, CRC Taylor & Francis, Reprint 2009
4. S. Palani, Control System Engineering, Tata McGraw-Hill Education Private Limited, First Reprint, 2010.
5. Yaduvir Singh and S. Janardhanan, Modern Control, Cengage Learning, First Impression 2010.
6. Katsuhiko Ogata, 'Modern Control Engineering', PHI Learning Private Ltd, 5 th Edition 2011

PTEE7302 ELECTRICAL MACHINES I L T P C
3 0 0 3

OBJECTIVES:

- To study the fundamental principles of Magnetic Circuits, Electro-mechanical energy conversion.
- To study the theory, operation and complete steady state behaviour of stationary and rotating transformers.
- Starting and speed control of three-phase induction motors.
- Principle of operation and performance of single phase induction motors.

UNIT I MAGNETIC CIRCUITS AND ELECTRO-MECHANICAL ENERGY CONVERSION 9

Ampere's circuit law - Faraday's and Lenz's law - B-H relations – flux linkage, inductance – magnetization curve - AC excitation - hysteresis loss and eddy current loss – characteristics of permanent magnet and its materials - energy balance, energy and co-energy – force and torque – singly excited system.

UNIT II TRANSFORMERS: THEORY 9

Principle of operation - Construction – equivalent circuit - phasor diagrams – determination of equivalent circuit parameters - efficiency - all-day efficiency - back to back test - voltage regulation.

UNIT III TRANSFORMERS: PERFORMANCE 9

Auto-transformer – three phase connections – phasor group – parallel operation of transformers - harmonics – three winding transformers – per unit system - tap changing - phase conversion – instrument transformer - concept of rotating transformers.

UNIT IV INDUCTION MACHINES: THEORY 9

Rotating magnetic field - principle of operation - construction – types of rotors – EMF, torque and power flow equations – equivalent circuit – Slip-torque characteristics – determination of equivalent circuit parameters - circle diagram – losses and efficiency - harmonics, cogging and crawling.

UNIT V INDUCTION MACHINES : PERFORMANCE 9

Three phase induction motor: starting methods - double cage rotors – Speed control - temperature rise – standards – induction generator. Single phase induction motor: Constructional details– Double revolving field theory - equivalent circuit – No load and blocked rotor test - starting methods – Shaded pole induction motor – AC servo motor.

TOTAL: 45 PERIODS

OUTCOMES:

- Understanding of fundamental concepts of magnetic circuits and energy conversion.
- Application knowledge of steady state performance analysis of induction machines.
- Knowledge on various starting and speed control methods of induction motor.
- Knowledge principle and operation of single-phase induction motor.

TEXT BOOKS:

1. Fitzgerald, A.E.Charles Kingsley Jr.Stephen D.Umans, 'Electric Machinery', McGraw Hill Book Company, Sixth Edition 2003.
2. Nagrath, I.J. and Kothari.D.P., Electric Machines', T.M.H. publishing Co. Ltd., New Delhi, Fourth Edition, 2010.

REFERENCES:

1. Say M.G "Performance and Design of Alternating Machines ' CBS Publishers and Distributors, New Delhi, First Indian Edition, Reprint 1998.
2. Irving L.Kosow, "Electric Machinery and Transformers", Prentice Hall of India Private Ltd., New Delhi, Second Edition, Reprint 2007.
3. Stephen J.Chapman, "Electric Machinery Fundamentals', "McGraw Hill Intl. Edition, New Delhi, Fourth Edition, 2005.
4. P.C.Sen, "Principles of Electric Machines and Power Electronics", Second Edition, Wiley Student Edition, 2007.
5. N.N. Parker Smith, "Problems in Electrical Engineering", 9th Edition, CBS Publisher, 2013.

PTEE7303 LINEAR INTEGRATED CIRCUITS L T P C
3 0 0 3

OBJECTIVES

- To study the IC fabrication procedure.
- To analyse circuit characteristics with signal analysis using Op-amp ICs.
- To design and construct application circuits with ICs as Op-amp, 555,565etc.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator ICs, ADCs.

UNIT I IC FABRICATION 9

IC classification, fundamentals of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types, Sigma- Delta ADC.

UNIT IV SPECIAL ICS 9

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase locked loop circuit functioning and applications, Analog multiplier ICs.

UNIT V APPLICATION ICS 9

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyse comprehend and design of analog electronic circuits involving linear ICs.

TEXT BOOKS:

1. Ramakant A.Gayakwad, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2009 / PHI.
2. D. Roy Choudhery, Sheil B. Jain, Linear Integrated Circuits, second edition, New Age publishers, 2010.

REFERENCES:

1. Robert F Coughlin, Fredrick, F. Driscold, Opamp and linear ICs, Pearson education, 4th edition, 2002.
2. James M. Fiore, Op Amps and Linear Integrated Circuits Concepts and Applications, Second Edition, Cengage Learning 2012.

PTEE7304 TRANSMISSION AND DISTRIBUTION LT P C
3 0 0 3

OBJECTIVES

- To impart knowledge about the configuration of the electrical power system
- To analyse and model different components of power system

UNIT I STRUCTURE OF POWER SYSTEM 9

Structure of electric power system: generation, transmission and distribution; Types of AC and DC distributors–distributed and concentrated loads–interconnection–EHVAC and HVDC transmission-Introduction to FACTS.

UNIT II TRANSMISSION LINE PARAMETERS 9

Parameters of single and three phase transmission lines with single and double circuits-Resistance, inductance and capacitance of solid ,stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition-application of self and mutual GMD; skin and proximity effects-interference with neighbouring communication circuits–Typical configurations, conductor types and electrical parameters of 765 kV, 400kV, 220 kV, 110kV, 66kVand33kVlines, corona discharges.

UNIT III MODELLINGAND PERFORMANCEOF TRANSMISSION LINES 9

Classification of lines–short line, medium line and long line-equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation, real and reactive power flow in lines, Power-circle diagrams, surge impedance loading, methods of voltage control ;Ferranti effect.

UNIT IV INSULATORS ANDCABLES 9

Insulators-Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables-Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3-core belted cable, D.C cables.

UNIT V MECHANICALDESIGN OFLINES ANDGROUNDING 9

Mechanical design of transmission line–sag and tension calculations for different weather conditions, Tower spotting, Types of towers, Sub-station Layout (AIS,GIS),Methods of grounding.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand transmission line models, insulations types and distribution schemes.

TEXTBOOKS:

1. S.N.Singh, ‘Electric Power Generation ,Transmission and Distribution’, Prentice Hall of India Pvt.Ltd, New Delhi, 2008.
2. B.R.Gupta,‘ Power System Analysis and Design’, S.Chand, New Delhi, Fifth Edition2005-08.

REFERENCES:

1. D.P.Kothari, I.J.Nagarath, ‘Power System Engineering’ Tata Mc Graw -Hill Publishing Company limited, New Delhi, 2007.

2. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009
3. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
4. HadiSaadat, 'Power System Analysis, 'PSA Publishing; Third Edition, 2010.
5. J.Brian, Hardy and Colin R.Bayliss' Transmission and Distribution in Electrical Engineering',Newnes;FourthEdition,2012.
6. Gorti Ramamurthy ,"Transmission and Distribution", Hand book of Electrical Power Distribution, 2009, Universities Press

PTEE7311 CONTROL AND INSTRUMENTATION LABORATORY LT P C
0 0 4 2

OBJECTIVES

- To provide knowledge on analysis and design of controller for the system along with basics of instrumentation

LIST OF EXPERIMENTS

CONTROL SYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modelling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks – AC and DC Bridges
9. Dynamics of Sensors/Transducers
10. a. Temperature
    b. Pressure
    c. Displacement
    d. Optical
    e. Strain
    f. Flow

10. Power and Energy Measurement

11. Signal Conditioning

    a. Instrumentation Amplifier

    b. Analog – Digital and Digital – Analog converters (ADC and DACs)

12. Process Simulation.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

CONTROL SYSTEMS:

1. PID kit – 1 No.
   DSO – 1No.
   CRO Probe – 2 Nos
2. Personal computers
3. DC motor – 1 No.
   Generator--1No.

Rheostats – 2 Nos
Ammeters
Voltmeters
Connecting wires (3/20))

4. CRO 30MHz – 1 No.
   2 MHz Function Generators – 1No.
5. Position Control Systems Kit (with manual) – 1 No.,
   Tacho Generator Coupling set
6. AC Synchro transmitter& receiver – 1No.
   Digital multimeters

INSTRUMENTATION:

7. R, L, C Bridge kit (with manual)

8. a) Electric heater – 1No.
      Thermometer – 1No.
      Thermistor (silicon type)
      RTD nickel type – 1No.

   b) 30 psi Pressure chamber (complete set) – 1No.
      Current generator (0 – 20mA)
      Air foot pump – 1 No. (with necessary connecting tubes)

   c) LVDT 20mm core length movable type – 1No.
      CRO 30MHz – 1No.

   d) Optical sensor – 1 No.
      Light source

   e) Strain Gauge Kit with Handy lever beam – 1No.
      100gm weights – 10 Nos

   f) Flow measurement Trainer kit – 1 No.
      (1/2 HP Motor, Water tank, Digital Milli ammeter, complete set)

9. Single phase Auto transformer – 1No.
10. Watt hour meter (energy meter) – 1No. Ammeter

Voltmeter Rheostat
Stopwatch
Connecting wires (3/20)

11. IC Transistor kit – 1No.

TOTAL: 60 PERIODS

OUTCOMES:

- Will be able to understand and apply basic science, circuit theory, theory control theory signal processing and apply them to electrical engineering problems.

PTEE7401 ELECTRICAL MACHINES II LT P C
3 0 0 3

OBJECTIVES:

- To study the machine windings and the MMF curves of armature and field windings and to derive the EMF and torque equations of rotating machines.
- To impart knowledge on Theory and performance of salient and non-salient pole synchronous generators.
- Principle of operation and performance of synchronous motor.
- To study the theory, operation and complete steady state behaviour of DC machines.

UNIT I ROTATING MACHINE THEORY 9

Doubly excited systems - permanent magnets - synchronous and reluctance principle - force, torque and power equation - armature winding - distribution and pitch factors - magnetic leakage - DC and AC windings - coil span - brushes - commutation - symmetry requirement.

UNIT II SYNCHRONOUS MACHINES: THEORY 9

Synchronous generators : Constructional details – Types – principle of operation - concept of space phasor – EMF, torque and Power equations – Armature reaction – Synchronous impedance. Synchronous motor: Principle of operation – Starting methods - Hunting - synchronous induction, reluctance, repulsion motor, stepper motor.

UNIT III SYNCHRONOUS MACHINES: PERFORMANCE 9

Voltage regulation – EMF, MMF, ZPF methods - Two reaction theory, slip test - Synchronization - parallel operation – Effect of change in excitation and mechanical input - Capability curves - variable load and constant excitation - constant load and variable excitation - V curves and inverted V curves - Synchronous condenser.

UNIT IV DC MACHINES: THEORY 9

Construction - Principle of operation - EMF and torque equation – armature reaction – commutation – interpoles and compensating windings – methods of excitation and characteristics.

UNIT V DC MACHINES: PERFORMANCE 9

Losses in machines - Testing and efficiency by direct and indirect methods - starting - speed control, Ward-Leonard control - constant torque and power control - braking - Permanent Magnet DC Motors – universal motor – DC servo motor.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand MMF curves for field and armature windings.
- Ability to formulate generalised form of EMF and Torque equations.
- Application knowledge of steady state performance analysis of synchronous machines.
- Knowledge on predetermination of voltage regulation of salient and non-salient pole generators, V-curves and inverted V-curves, power factor correction.
- Application knowledge of DC machines theory.
- Knowledge on performance on DC machines.

TEXT BOOKS:

1. Fitzgerald, A.E.Charles Kingsley Jr.Stephen D.Umans, 'Electric Machinery', Mc Graw Hill Book Company, Sixth Edition 2003.
2. Nagrath, I.J. and Kothari.D.P., Electric Machines', T.M.H. publishing Co. Ltd., New Delhi, Fourth Edition, 2010.

REFERENCES:

1. Say M.G "Performance and Design of Alternating Machines 'CBS Publishers and Distributors, New Delhi, First Indian Edition, Reprint 1998.
2. Irving L.Kosow, "Electric Machinery and Transformers", Prentice Hall of India Private Ltd., New Delhi, Second Edition, Reprint 2007.
3. Stephen J.Chapman, "Electric Machinery Fundamentals', "McGraw Hill Intl. Edition, New Delhi, Fourth Edition, 2005.
4. P.C.Sen, "Principles of Electric Machines and Power Electronics", Second Edition, Wiley Student Edition, 2007.
5. N. Parker Smith, "Problems in Electrical Engineering", 9th Edition, CBS Publisher, 2013.

PTEE7402 POWER ELECTRONICS LT P C
3 0 0 3

OBJECTIVES:

- To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.
- To get an overview of different types of power semiconductor devices and their dynamic characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations of AC voltage controller.

UNIT I SWITCHING POWER SUPPLIES 9

SCR and MOSFET dynamic behaviour - driver and snubber circuits - low power high switching frequency switching Power supplies, buck, boost, buck-boost converters – Isolated topologies – resonant converters - switching loss calculations and thermal design.

UNIT II INVERTERS 9

IGBT : Static dynamic behaviour - single phase half bridge and full bridge inverters - SCR based : six step three phase VSI, ASCI - PWM (both unipolar and Bipolar) – third harmonic injected sine PWM - space vector PWM – selective harmonic elimination.

UNIT III UNCONTROLLED RECTIFIERS 9

Power Diode – half wave rectifier – mid-point secondary transformer based full wave rectifier – bridge rectifier – voltage doubler circuit – distortion factor – capacitor filter for low power rectifiers – LC filters – Concern for power quality – three phase diode bridge.

UNIT IV CONTROLLED RECTIFIERS 9

Two transistor analogy based turn- ON – turn ON losses – thermal protection – controlled converters (1 pulse, 2 pulse, 3 pulse, 6 pulse) - displacement factor – ripple and harmonic factor - power factor mitigation, performance parameters – effect of source inductance - inverter angle limit.

UNIT V AC PHASE CONTROLLERS 9

TRIAC triggering concept with positive and negative gate pulse triggering, TRIAC based phase controllers - various configurations for SCR based single and three phase controllers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to simulate and design different power converters
- Ability to implement and verify the performance specifications of power converters.

TEXT BOOKS:

1. Ned Mohan, T.M.Undeland, W.P.Robbins, ”Power Electronics: Converters, applications and design”, John Wiley and Sons, 3rd Edition (reprint), 2009.
2. Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall India, 3rd Edition, New Delhi, 2004.

REFERENCES:

1. Cyril.W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2003.
3. PhilipT.Krein, Elements of Power Electronics, Oxford University Press, 2013.
4. P.C.Sen, Power Electronics, Tata McGraw-Hill, 30th reprint, 2008.

PTEE7403 POWER SYSTEM ANALYSIS LT P C
3 0 0 3

OBJECTIVES

- To model and analyse the power system under steady state operating condition.
- To apply numerical methods to solve the power flow problem.
- To model and analyse the system under balanced and unbalanced conditions.
- To model and analyse the stability of power system when it is subjected to a fault.

UNIT I INTRODUCTION 9

Need for system planning and operational studies–Different types of power system analysis-Modern Power System Operation and Control –Single line diagram–per phase and per unit

analysis–Generator-transformer transmission line and load representation for differentpowersystemstudies.-Primitivenetwork-constructionofY-bususing inspection and singular transformation methods–Z-bus.

UNIT II POWER FLOW ANALYSIS 9

Importance of power flow analysis in planning and operation of power systems-statement of power flow problem-classification of buses-development of power flow modelling of complex variables form-iterative solution using Gauss-Seidel method-Q-limit check for voltage controlled buses–power flow model in polar form –iterative solution using Newton-Raphson method.

UNIT III FAULT ANALYSIS– BALANCED FAULTS 9

Importance of short circuit analysis-assumptions in fault analysis-analysis using Thevenin's theorem-Z-bus building algorithm-fault analysis using Z-bus–computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS–UNBALANCED FAULTS 9

Introduction to symmetrical components–sequence impedances–sequence circuits of synchronous machine ,transformer and transmission lines-sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

UNIT V STABILITY ANALYSIS 9

Importance of stability analysis in power system planning and operation- classification of power system stability-angle and voltage stability–Single Machine Infinite Bus (SMIB) system: Development of swing equation -equal area criterion -determination of critical clearing angle and time–solution of swing equation by modified Euler method and Runge - Kutta fourth order method.

TOTAL: 45 PERIODS

OUTCOMES:

- The students are equipped with power flow, short-circuit and transient stability studies that are useful for transmission expansion planning and day-today operation of power system.

TEXTBOOKS

1. John J.Grainger and W.D.Stevenson Jr.,'Power System Analysis' ,Tata McGraw-Hill, Sixth reprint,2010.
2. Hadi Saadat, 'Power System Analysis', Tata Mc Graw Hill Education Pvt.Ltd., New Delhi, 21st reprint 2010.

REFERENCES

1. NagrathI.J.and Kothari D.P.,' Modern Power System Analysis', Tata McGraw Hill,14th reprint,2009.
2. Kundur P., 'Power System Stability and Control, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi,10th reprint2010.
3. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition,2007.
4. T.K Nagsarkar ,'Power System Analysis',2nd edition, Oxford Press,2014.

PTEE7411 ELECTRICAL MACHINES LABORATORY L T P C
0 0 4 2

AIM
To study the performance characteristics of DC machines, Transformers, synchronous machines and induction machines

OBJECTIVES
To experimentally verify the principle of operation, performance and characteristics of DC machines, Transformers, Synchronous machines and Induction machines using load tests and predetermination tests.
To study DC motor and three phase induction motor starters.

LIST OF EXPERIMENTS
1. Open circuit and load characteristics of separately excited and self excited D.C. generator
2. Load test on D.C shunt motor
3. Swinburne's test
4. Speed control of D.C shunt motor
5. Load test on single phase transformer
6. Open circuit and short circuit test on single phase transformer (Determination of equivalent circuit parameters)
7. Regulation of three-phase alternator by EMF and MMF methods.
8. V& Inverted V Curves of synchronous motor
9. Load test on three-phase induction motor
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on single-phase induction motor.
12. Study of D.C motor and induction motor starters

TOTAL : 60 PERIODS

OUTCOMES:
Ability to perform experiments on all conventional electrical machines
To study their complete performance characteristics under different operating conditions.
OUTCOMES:
1. Complete performance characteristics of AC machines and transformers are obtained.
2. AC motor starters and three phase transformer connections are studied.

PTEE7501 HIGH VOLTAGE ENGINEERING LT P C
3 0 0 3

OBJECTIVES

- To impart knowledge about causes, effects of over voltages, dielectric breakdown mechanism and to emphasis the need for generation, measurement and testing of High voltages and currents.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – Reflection and Refraction of Travelling waves- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators**.**

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards– Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to analyze the different electrical stress in a Power System and design & develop appropriate insulation schemes

TEXT BOOKS

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', 4thEdition Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2009.
2. E.Kuffel and W.S. Zaengl, J.Kuffel, High voltage Engineering fundamentals, Newnes Second Edition ,Elsevier , New Delhi 2005.

REFERENCES

1. L.L.Alston, High Voltage Technology, Oxford University Press, First Indian Edition 2011.
2. C.L.Wadhwa, High voltage Engineering, New Age International Publishers, Third Edition, 2010
3. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.
4. Subir Ray." An Introduction to High Voltage Engineering "PHI Learning Private Limited, New Delhi, Second Edition-2011

PTEE7502 POWER SYSTEM OPERATION AND CONTROL LT P C
3 0 0 3

OBJECTIVES

- To have an overview of power system operation and control,
- To model power-frequency dynamics and to design power-frequency controller.
- To model reactive power -voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- To study the economic operation of power system.
- To teach about SCADA and its application for real time operation and control of power systems.

UNITI INTRODUCTION 9

An overview of power system operation and control-system load variation-load characteristics-load curves and load-duration curve-load factor-diversity factor-Importance of load forecasting quadratic and exponential curve fitting techniques of forecasting- system reserve requirements –plant level and system level controls .

UNITII REALPOWER-FREQUENCYCONTROL 9

Basics of speed governing mechanism and modelling-speed-load characteristics–load sharing between two synchronous machines in parallel-control area concept-LFC control of a single-area system-static and dynamic analysis of uncontrolled and controlled cases-two-area system – modelling-static analysis of uncontrolled case-tie line with frequency bias control –state variable model –integration of economic dispatch control with LFC.

UNITIII REACTIVEPOWER–VOLTAGECONTROL 9

Generation and absorption of reactive power-basics of reactive power control-excitation systems – modelling - static and dynamic analysis - stability compensation-methods of voltage control:tap-changingtransformer,SVC(TCR+TSC)andSTATCOM–secondaryvoltagecontrol.

UNITIV UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Formulation of economic dispatch problem–I/O cost characterization–incremental cost coordination equations with out and with loss (No derivation of loss coefficients)-solution by direct method and λ-iteration method-statement of unit commitment problem–priority-list method-forward dynamic programming.

UNITV COMPUTERCONTROLOFPOWERSYSTEMS 9

Need for computer control of power systems-concept of energy control centre-functions-system monitoring-data acquisition and control-system hardware configuration SCADA and EMS functions-state estimation–WLSE-Contingency Analysis state transition diagram showing various state transitions and control strategies.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to analyse load profiles and EMS functions
- Ability to understand and analyse power system operation, stability, control and protection.

TEXTBOOKS

1. Olle.I.Elgerd, 'Electric Energy Systems theory-An introduction', Tata Mc Graw Hill EducationPvt.Ltd.,NewDelhi,34th reprint2010.

2. Allen.J.Wood and Bruce F.Wollenberg, 'Power Generation, Operation andControl', John Wiley& Sons,Inc.,2003.

REFERENCES

1. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt.Ltd., New Delhi, Third Edition,2010.
2. NagrathI.J.and Kothari D.P.,'Modern Power System Analysis',TataMcGraw-Hill,14th reprint,2009.
3. KundurP., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10threprint2010.
4. Hadi Saadat, 'Powe r System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21streprint 2010.

PTEE7503 PROTECTION AND SWITCH GEAR LT P C
3 0 0 3

OBJECTIVES:

- To discuss about the nature, types and causes of faults in Power System and the construction and operating principle of protective components.

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults– fault current calculation – Methods of Neutral grounding – Zones of protection and essential qualities of protection .

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Application of Current transformers and Potential transformers in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Overcurrent protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Acquire the knowledge about the faults in Power System and analyze the design of protective scheme with suitable selection of protective components.

TEXT BOOKS:

1. Sunil S.Rao, Switchgear and Protection, Khanna publishers, New Delhi, 2008.
2. Y.G.Paithankar and S.R.Bhide, Fundamentals of power system protection, Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi – 2010

REFERENCES:

1. BadriRam ,B.H.Vishwakarma, Power System Protection and Switchgear, New Age International Pvt Ltd Publishers, Second Edition 2011.
2. B.Rabindranath and N.Chander, Power System Protection and Switchgear, New Age International (P) Ltd., First Edition 2011.
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, A Text Book on Power System Engineering, Dhanpat Rai & Co., 1998.
4. C.L.Wadhwa, Electrical Power Systems, 6th Edition, New Age International (P) Ltd., 2010
5. Ravindra P.Singh, " Switchgear and Power System Protection " PHI Learning Private Ltd.,New Delhi 2009.

PTEE7511 POWER ELECTRONICS AND DRIVES LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To study, analyse the performance of different power electronic converter circuits.
- To simulate different power electronic converter circuits and analyse their performance

LIST OF EXPERIMENTS

1. Characteristics of SCR,TRIAC, MOSFET and IGBT
2. AC to DC half controlled converter and fully controlled Converters
3. Step down and step up MOSFET based choppers
4. IGBT based single phase PWM inverter and three phase PWM inverter
5. AC Voltage controller
6. Switched mode power converter.
7. Simulation of PE circuits (1Φ&3Φsemiconverter,1Φ&3Φfullconverter,dc-dc converters ,ac voltage controllers).
8. Speed control of converter fed DC motor
9. Speed control of chopper fed DC motor
10. V/F control of three phase induction motor

TOTAL:60 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

1. Device characteristics(for SCR, MOSFET,TRIACand IGBT kitwith built in power supplyandmeters) -2each
2. Single phase SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter –2each

3. MOSFET based step up and step down choppers –1each
4. IGBT based single phase PWM inverter module–2
5. IGBT based three phase PWM inverter module-2
6. Switched mode power converter module–2
7. SCR&TRIAC based single phase ACcontrolleralongwithlamporrheostatload-2
8. Cyclo-converter kit with firing module–2
9. Dual regulated DC power supply with common ground
10. Cathode Ray Oscilloscope– 10
11. Isolation Transformer –5
12. Single phase Autotransformer–3
13. Components (Inductance, Capacitance) 3setfor each
14. Multimeters–5
15. LCR meter –3
16. Rheostats of various ranges –2sets of10value,Worktables –10
17. DC and AC meters of required ranges - 20

OUTCOMES:

- Ability to design and analyse the performance and applications of various power converters
- Design of power converters using Software.

PTEE7601 DESIGN OF ELECTRICAL APPARATUS L T P C
3 0 0 3

OBJECTIVES

To provide sound knowledge about constructional details and design of various electrical machines, in order

- To study magnetic circuit parameters and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines and synchronous machines.
- To introduce the importance of computer aided design method.

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram -Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators -Computer program: Design of Stator main dimensions-Brushless DC Machines

TOTAL : 45 PERIODS

OUTCOMES:

- Understand basics of design considerations for rotating and static electrical machines
- Ability to model and analyse electrical apparatus and their application to Electrical Engineering.

TEXT BOOKS

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, Fifth Edition, 1984.
2. M V Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Lt, 2011.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.
2. 'Electrical Machine Design', Balbir Singh, Vikas Publishing House Private Limited, 1981.
3. K.M.Vishnumurthy 'Computer aided design of electrical machines' B S Publications,2008

PTEE7602 **SOLID STATE DRIVES** **LT P C**
3 0 0 3

OBJECTIVES:

- To understand steady state operation and transient dynamics of a motor load system.
- To study and analyze the operation of the converter / chopper fed dc drive, both qualitatively and quantitatively.
- To study and understand the operation and performance of AC motor drives.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive – continuous and discontinuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control – energy efficient drive – v/f control – constant air gap flux – field weakening mode – voltage / current fed inverter – closed loop control.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor: Margin angle control and power factor control – permanent magnet synchronous motor.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with current and speed feedback – armature voltage control and field weakening mode – design of controllers; current controller and speed controller-converter selection and characteristics.

TOTAL : 45 PERIODS

OUTCOMES:

- Basic requirement of motor selection for different load profiles are studied.
- Stability aspects of drive systems are studied.
- Important features of DC and AC drives are studied.
- Controller design for DC drives is studied.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.

REFERENCES:

1. S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 1993.
2. Murphy J.M.D and Turnbull, Thyristor Control of AC Motor, Pergamon Press, Oxford 1988.
3. Gopal K.Dubey, Power semiconductor controlled Drives, Prentice Hall Inc., New Jersey, 1989.
4. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice hall of India, 2001.

PTEE7611 POWER SYSTEM SIMULATION LABORATORY LT P C
0 0 4 2

OBJECTIVES

- To study the modelling and parameter estimation of transmissions lines
- To study the various methods used for solving load flow analysis.
- To study the stability, dynamics and transient analysis of power systems.
- To understand the concept of economic dispatch.

LISTOFEXPERIMENTS:

1. Computation of Parameters and Modelling of Transmission Lines
2. DC Power Flow Analysis
3. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
4. Load Flow Analysis using Gauss-Seidel Method
5. Load Flow Analysis using Newton-Raphson Method.
6. Fault Analysis
7. Transient Stability Analysis :Single-Machine Infinite Bus System
8. Transient Stability Analysis of Multi machine Power Systems
9. Electromagnetic Transients in Power Systems
10. Load –Frequency Dynamics of Single-Area and Two-Area Power Systems
11. Economic Dispatch in Power Systems.
12. Contingency Analysis – Generation Shift factor & line Outage distribution factor.

TOTAL: 60 PERIODS

LABORATORY REQUIREMENT FOR A BATCH OF 30 STUDENTS

1. Personal computers (Pentium-IV,80 GB, 512MBRAM)– 25nos
2. Printer laser- 1No.
3. Dotmatrix-1No.
4. Server (PentiumIV, 80 GB, 1GBRAM) (High Speed Processor)–1No.
5. Software: Any Power System Simulation Software- 5 licenses
6. Compliers: C, C++, VB,VC++ -25 users

OUTCOMES:

- Ability to develop algorithms to study load flow, short circuit and stability analysis.

PTEE7711 **PROJECT WORK** **L T P C**
0 0 9 6

OBJECTIVES :

The student should be made to:

- learn methodology to select a good project and able to work in a team leading to development of hardware/software product.
- prepare a good technical report.
- Gain Motivation to present the ideas behind the project with clarity.

A project must be selected either from research literature published list or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen the comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL : 135 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- select a good project and able to work in a team leading to development of hardware /software product.
- prepare a good technical report and able to present the ideas with clarity.

PTMA7001 **DISCRETE MATHEMATICS** **L T P C**
3 0 0 3

OBJECTIVES :

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as semi groups, monoids and groups.

UNIT I LOGIC AND PROOFS **9**

Propositional Logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS 9

Mathematical induction – Strong induction and well ordering – The basics of counting - The pigeonhole principle – Permutations and combinations – Recurrence relations - Solving linear recurrence relations using generating functions – Inclusion - Exclusion - Principle and its applications.

UNIT III GRAPHS 9

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 9

Algebraic systems – Semi groups and monoids – Groups - Subgroups - Homomorphisms – Normal subgroup and coset - Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 9

Partial ordering – Posets – Lattices as Posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL : 45 PERIODS

OUT COMES :

On completion of the module the student should be able to:

- Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
- Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving.
- Use effectively algebraic techniques to analyse basic discrete structures and algorithms.
- Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.
- Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

TEXT BOOKS :

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 7th Edition, Special Indian edition, 2011.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES :

1. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education Asia, Delhi, 4th Edition, 2007.
2. Thomas Koshy," Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Seymour Lipschutz and Mark Lipson,"Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

PTMA7071	PROBABILITY AND STATISTICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES 9

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 9

Sampling distributions - Tests for single mean, proportion, difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT IV DESIGN OF EXPERIMENTS 9

Completely randomized design – Randomized block design – Latin square design - 2^2 - Factorial design - Taguchi's robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 9

Control charts for measurements ($\overline{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 45 PERIODS

OUT COMES :

- Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions.
- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

TEXT BOOKS :

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2011.

REFERENCES :

1. Devore. J.L., " Probability and Statistics for Engineering and the Sciences ", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics

for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 3rd Edition, 2004.
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, New Delhi, 2004.
5. Papoulis. A and Unnikrishnapillai. S., " Probability, Random Variables and Stochastic Processes ", McGraw Hill Education India , 4th Edition , New Delhi , 2010.

PTGE7071 DISASTER MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXT BOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES **L T P C**

(Common to all branches) **3 0 0 3**

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES **9**

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment –

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY 9

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and chernobyl as case studies.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES

- Students will have the ability to perform with professionalism , understand their rights , legal ,ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000
5. R.Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

PTGE7073 **HUMAN RIGHTS** **LT P C**
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOMES :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PTGE7074 **TOTAL QUALITY MANAGEMENT** **L T P C**
3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES **9**

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning--Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality – New management tools – Six-sigma Process Capability–Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM **9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.

PTGE7075	INTELLECTUAL PROPERTY RIGHTS	L T P C 3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs **10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS **10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs **7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C
3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),"The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PTMG7001 MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING LT P C

3 0 0 3

OBJECTIVES

- To study the features of demand supply analysis.
- To study the pricing objectives and its methods.
- To study the basics of accounting and its types.
- To study the procedures for capital budgeting and investments.

UNIT I DEMAND & SUPPLY ANALYSIS 9

Firm: Types & objectives - Managerial decisions - Fundamental economic concepts Demand - Types of demand - Determinants of demand - demand function - demand elasticity - demand forecasting - supply - Determinants of supply - supply function - supply elasticity

UNIT II PRODUCTION AND COST ANALYSIS 9

Production function - returns to scale - Managerial uses of production function. Cost concepts - cost function - Determinants of cost - Short run and long run cost curves

UNIT III PRICING 9

Pricing Objectives - Determinants of price - Pricing under different market structures – price discrimination - pricing methods in practice

UNIT IV FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT) 9

Basics of accounting - Journal, Ledger trial balance - Final accounts with Adjustment - Financial Ratio Analysis - Cash flow analysis - Fund flow analysis - Analysis and interpretation of

financial statements - Comparative financial statements

UNIT V CAPITAL BUDGETING **9**

Investments - Methods of capital budgeting and accounting for risk in capital budgeting

TOTAL:45 PERIODS

OUTCOMES:

- Basics of demand, supply and cost analysis are studied.
- Different methods of financial accounting and capital budgeting are studied.

TEXT BOOKS

1. Samuelson, Paul A and Nordhaus W.D., "Economics", Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
2. Salvatore Dominick, "Managerial Economics in a global economy", Thomson South Western, 4th edition, 2001.
3. S.N. Maheshwari, "Financial Accounting", Fourth Edn.,Vikas Publishers House, New Delhi.
4. Khan and Jain, "Management Accounting" Tata McGraw Hill Education, 2006

REFERENCES

1. Paresh Shah, "Basic Financial Accounting for Management" Oxford University Press, New Delhi, 2007.
2. James C. Van home and John M. Wachowics Jr. "Fundamentals of financial Management" Prentice Hall of India, New Delhi, 11th Edition, 2004.
3. VL. Mote, Samuel Paul, G.S. Gupta, "Managerial Economics Concepts & Cases, "Tata McGraw Hill Publishing Company Limited, 38th Reprint, 2005.

PTMG7751 PRINCIPLES OF MANAGEMENT **LT P C**
3 0 0 3

OBJECTIVES:

- To study the Evolution of Management
- To study the functions and principles of management
- To learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS **9**

Definition of Management – Science or Art – Manager vs. Entrepreneur- Types of Managers- Managerial Roles and Skills – Evolution of Management –Scientific, Human Relations, System and Contingency Approaches– Types of Business Organization- Sole Proprietorship, Partnership, Company- Public and Private Sector Enterprises- Organization Culture and Environment – Current Trends and Issues in Management.

UNIT II PLANNING **9**

Nature and Purpose of Planning – Planning Process – Types of Planning – Objectives – Setting Objectives – Policies – Planning Premises – Strategic Management – Planning Tools and Techniques – Decision Making Steps and Process.

UNIT III ORGANISING **9**

Nature and Purpose – Formal and Informal Organization – Organization Chart– Organization Structure – Types – Line and Staff Authority – Departmentalization – Delegation of Authority – Centralization and Decentralization –Job Design – Human Resource Management –HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career Planning and Management.

UNIT IV DIRECTING 9

Foundations of Individual and Group Behavior– Motivation – Motivation Theories – Motivational Techniques – Job Satisfaction – Job Enrichment – Leadership – Types and Theories of Leadership – Communication – Process of Communication – Barrier in Communication – Effective Communication – Communication and IT.

UNIT V CONTROLLING 9

System and Process of Controlling – Budgetary and Non-Budgetary Control Techniques – Use of Computers and IT in Management Control – Productivity Problems and Management – Control and Performance – Direct and Preventive Control – Reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would have gained the ability to learn the different principles and techniques of management in planning, organizing, directing and controlling.

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, " Management", Prentice Hall of India, Tenth Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, Sixth Edition, 2004.

REFERENCES:

1. Stephen A. Robbins, David A. Decenzo and Mary Coulter, "Fundamentals of Management" Pearson Education, Seventh Edition, 2011.
2. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
3. Harold Koontz and Heinz Weihrich "Essentials of Management" Tata McGraw Hill, 1998.
4. Tripathy PC and Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

PTEE7001 ADAPTIVE CONTROL LT P C
3 0 0 3

OBJECTIVES

To illustrate the concept of system identification and adaptive control
To give an introductory knowledge about black-box approach based system identification
To give adequate knowledge on batch and recursive identification
To give basic knowledge on Computer Controlled Systems
To introduce the design concept for adaptive control schemes

UNIT I NON-PARAMETRIC METHODS 9

Non-parametric methods - Transient analysis - frequency analysis - Correlation analysis -Spectral analysis - Input signal design for identification

UNIT II PARAMETRIC METHODS 9

Least squares estimation – Analysis of the least squares estimate - Best linear unbiased estimate – Model parameterizations - Prediction error methods

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least square method - Model validation –Model structure determination - Introduction to closed loop system identification

UNIT IV ADAPTIVE CONTROL SCHEMES 9

Introduction – Auto-tuning of PID controller using relay feedback approach – Types of adaptive control, Gain scheduling, Model reference adaptive control, Self–tuning controller – Design of gain scheduled adaptive controller – Applications of gain scheduling

UNIT V MRAC & STR 9

STR – Pole placement design – Indirect STR and direct STR – MRAC - MIT rule – Lyapunov theory – Relationship between MRAC and STR

TOTAL: 45 PERIODS

OUTCOMES:

- Various system identification techniques are studied.
- Features of adaptive control and other control techniques viz., STR, MRAC are studied.

TEXTBOOKS

1. T. Soderstrom and Petre Stoica, System Identification, Prentice Hall International (UK) Ltd. 1989
2. Karl J. Astrom and Bjorn Witten mark, Adaptive Control, Pearson Education, Second edition, Fifth impression, 2009

REFERENCES

1. L. Ljung, System Identification - Theory for the User, 2nd edition, PTR Prentice Hall, Upper Saddle River, N.J., 1999 2. Narendra and Annasamy, " Stable Adaptive Control Systems".

PTEE7002 ADVANCED CONTROL SYSTEMS LT P C
3 0 0 3

OBJECTIVES

To gain knowledge in design of state variable systems, analysis of non-linear systems and introduction of optimal control

- To study the state variable design
- To provide adequate knowledge in the phase plane analysis
- To study describing function analysis
- To analyse the stability of the systems using different techniques
- To introduce the concepts on design of optimal controller

UNIT I STATE VARIABLE DESIGN 9

Control law design – State feedback and pole placement - Estimator design – Regulator design - Combined control law and estimator – Introduction of the reference input – Integral control and disturbance estimation – Effect of delays

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearizing non-linear systems - Concept of phase portraits – Singular points – Limit cycles– Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III DESCRIBING FUNCTION ANALYSIS 9

Basic concepts - Derivation of describing functions for common non-linearities – Analysis of non-linear systems – Limit cycle - Stability

UNIT IV STABILITY ANALYSIS 9

Introduction – Concept of stability – Equilibrium points- Lyapunov's stability theorems - Lyapunov's direct method for LTI systems – Lyapunov's method for non-linear systems - Krasovski's theorem on Lyapunov function

UNIT V OPTIMAL CONTROL 9

Problem formulation - Linear quadratic regulator - Finite and infinite time - Variational approach to optimal control problem - Solution of Ricatti equation - Differential and Algebraic

TOTAL: 45 PERIODS

OUTCOMES

- Features of tools used for studying the nature of non-linear systems are studied.
- Basics of stability and the assessment of stability are studied.
- Basics of optimal control and its features are studied.

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, Control Systems Engineering, New Age International Publishers, Fourth Edition, 2012.
2. K P Mohandas, Modern Control Engineering, Sanguine Technical Publishers, 2008

REFERENCES

1. George J. Thaler, Automatic Control Systems, Jaico Publishers, 1993
2. Ashish Tewari, Modern Control Design with Matlab and Simulink, John Wiley, New Delhi, 2002
3. M. Gopal, Modern Control System Theory, New Age International Publishers, 2005.
4. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, Feedback Control of Dynamic Systems, Fourth edition, Pearson Education, 2002
5. William A. Wolovich, Automatic Control Systems, Oxford University Press, First Indian Edition 2010.

PTEE7003 ANALYSIS OF ELECTRICAL MACHINES LT P C
3 0 0 3

OBJECTIVES

- To study the fundamentals of electromechanical energy conversion process in electrical equipments.
- To study the theory of transformation of multi-phase circuits and systems and its application to multi-phase induction and synchronous machines.
- To develop the time domain mathematical model of DC and AC machines and analyse their

steady state and dynamic state performance

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION 9

General expression of stored magnetic energy, co-energy and force/ torque – example using single and doubly excited system – Calculation of air - gap mmf and per phase machine inductance using physical machine data.

UNIT II DC MACHINES 9

Voltage and torque equations – dynamic characteristics of permanent magnet and shunt DC machines – state equations - solution of dynamic characteristics by Laplace transformation.

UNIT III REFERENCE FRAME THEORY 9

Static and rotating reference frames – transformation of variables – reference frames – transformation between reference frames – transformation of a balanced set –balanced steady state phasor and voltage equations.

UNIT IV INDUCTION MACHINES 9

Voltage and torque equations – transformation for rotor circuits – voltage and toque equations in reference frame variables – analysis of steady state operation – free acceleration characteristics – dynamic performance for load and torque variations – dynamic performance of single phasing operation.

UNIT V SYNCHRONOUS MACHINES 9

Voltage and Torque Equation – voltage Equation in arbitrary reference frame and rotor reference frame – Park equations - steady state analysis – dynamic performances for torque variations- dynamic performance during three phase fault – transient stability limit – critical clearing time – computer simulation.

TOTAL: 45 PERIODS

OUTCOMES:

- Development of generalised force/torque equations of electro-mechanical systems from energy and co-energy equations are studied and analysed.
- Transformation theory is studied and applied to three-phase induction and synchronous machines.
- Dynamic state models of DC and AC machines are developed and their complete time domain performance is analysed.

TEXT BOOKS

1. Paul C.Krause, OlegWasyzczuk, Scott S, Sudhoff, “Analysis of Electric Machinery and Drive Systems”, IEEE Press, Second Edition**,** 2002.
2. R.Krishnan, “Electric Motor Drives, Modeling, Analysis and Control , Prentice Hall of India, 2002.
3. P.S. Bhimbra, Generalised theory of Electric machinery, Khanna Publishers, Fifth Edition, 2012, New Delhi.

REFERENCES

1. Samuel Seely, “Electromechanical Energy Conversion”, McGraw Hill Publishing Company**,** Reprint 2000
2. A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D, Umans, “ Electric Machinery”, Tata McGraw Hill, Sixth Edition, Reprint 2012.
3. P.C.Sen, “Principles of Electric Machines and Power Electronics”, John Wiley, 2007.

PTEE7004 COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS L T P C
3 0 0 3

OBJECTIVES

To impart knowledge on

- Problem formulation for field computation Finite Element analysis
- Computer aided design of practical problems

UNIT I INTRODUCTION 9

Review on electromagnetic theory – Basic field equations, calculation of field distribution, inductance, capacitance, force and torque, Review on conventional electrical machine design methodology – computer aided design aspects - advantages.

UNIT II CAD PACKAGES 9

Numerical methods for solving field problems, recent developments, problem formulation – governing equations – modelling – boundary conditions and material characteristics.

UNIT III FINITE ELEMENT ANALYSIS 9

Mathematical formulation for 2-D planar and axial symmetry problems – discretization – shape functions – element and global matrices/vectors – solution – post processing.

UNIT IV FILED ANALYSIS USING FEA(PRACTICALS 9

Electrostatics, Magneto statics – linear and non-linear problems, permanent magnet, eddy current analysis, calculation of force/torque.

UNIT V DESIGN EXAMPLES (PRACTICALS) 9

Design of cylindrical magnetic devices, transformer, Rotating machines.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to design electrical apparatus using finite element package.

TEXT BOOKS

1. Sheppard.J.Salon " Finite Element Analysis of Electrical Machines", Springer International Edition, First Indian Reprint, 2007
2. Nicola Bianchi " Electrical Machine Analysis using Finite Elements", Taylor & Francis, 2005.

REFERENCES

1. K.J.Binns, P.J. Lawrenson, C.W. Trowbridge, " The analytical and numerical solution of electrical and magnetic fields", John Wiley & Sons, 1993.
2. Nathan Ida, Joao P A Bastos, "Electromagnetics and calculation of fields", Springer Verlag, Second Edition, 1997.
3. P P. Silvester, Ferrari, "Finite Elements for Electrical Engineers", Cambridge University Press, Third Edition, 1996.
4. M V K Chari, P P Silvester, " Finite Elements in Electrical and Magnetic Field problems", John Wiley, 1980.
5. S.S.Rao, "The Finite Element Method in Engineering", Elsevier,2011.
6. J.N.Reddy, "An Introduction to the Finite Element Method", McGrawHill International Editions, Third illustrated edition, 2006.

PTEE7005 DATA STRUCTURES AND ALGORITHMS LT P C
3 0 0 3

OBJECTIVES

- To provide an introduction to computer algorithms and data structures, with an emphasis on foundational material.
- To have a good understanding of the fundamental data structures used in computer science
- To have a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
- To analyze the space and time efficiency of most algorithms
- To design new algorithms or modify existing ones for new applications and reason about the efficiency of the result

UNIT I INTRODUCTION AND BASIC DATA STRUCTURES 9

Problem solving techniques and examples-Abstract Data Type (ADT)-The list ADT Arrays-Stacks and Queues: Implementation and Application

UNIT II ADVANCED DATA STRUCTURES 9

Trees: Preliminaries-Binary Tree- Tree traversals-Binary search Trees-AVL Trees

UNIT III SORTING AND HASHING 9

Sorting by Selection- Sorting by Insertion- Sorting by Exchange- Sorting by Diminishing Increment-Heap Sort- Heaps Maintaining the Heap Property-Building a Heap- Heap sort Algorithm-Quick sort- Description-Performance of quick sort-Analysis of Quick Sort. Hashing - General idea-Hash functions-Separate Chaining-Open Addressing-Rehashing-Extendible Hashing

UNIT IV ALGORITHM DESIGN TECHNIQUES 9

The role of algorithms in computing-Getting Started-Growth of functions. Divide and conquer-dynamic programming-Greedy Algorithm – Backtracking.

UNIT V GRAPHS ALGORITHMS 9

Elementary Graph Algorithms-Minimum Spanning Trees-Single-source shortest paths-All pairs shortest paths

TOTAL:45 PERIODS

OUTCOMES:

- Fundamentals of data structures and algorithms are studied.
- Features of various algorithms for different applications are studied.

TEXT BOOKS

1. M A Weiss," Data Structures and Algorithm Analysis in C++",3rd Edition, Pearson Education, 2007.
2. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest," Introduction to Algorithms", 2nd Edition, prentice Hall of India, 2002

REFERENCES

1. Malik,"Data Structures using C++",Cengage Learning , 2013
2. R G Dromey,"How to solve it by computers", Pearson Education Asia, 2005.
3. Robert L Kruse, Clovis L Tando and Bruce P Leung, "Data structures and Program Design in C", 2nd Edition, Prentice Hall of India,1991.
4. Jean Paul Trembley, Paul G Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, 2007.

PTEE7006 DIGITAL SIGNAL PROCESSING LT P C
3 0 0 3

OBJECTIVES:

- To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain.
- To classify signals and systems & their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

UNIT I INTRODUCTION 9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Introduction to Fourier Transform– Discrete time Fourier transform.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping -Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS 9

Introduction – Architecture of one DSP processor– Features – Addressing Formats – Functional modes - Introduction to Commercial Processors

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply Fourier transforms for processing of signals
- Ability to design and develop digital filters algorithms in digital signal processor platforms.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2009.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 2006.

REFERENCES:

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.
2. Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson Education, Second edition, 2002.
3. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

PTEE7007 **EHV POWER TRANSMISSION** **LT P C**
3 0 0 3

OBJECTIVES

- To impart knowledge on EHV AC, HVDC and FACTS transmission trends with parameter calculations and study on the effect of EHV lines on living organisms

UNIT I TRANSMISSION LINE TRENDS **9**

Standard transmission voltages, average values of line parameters – Power handling capacity and line losses - number of lines.

UNIT II LINE AND GROUND PARAMETERS **9**

Resistance, Temperature rise and current carrying capacity of conductors. Properties of Bundle conductors – Calculation of L and C parameters – Modes of propagation – Effect of Earth.

UNIT III HIGH VOLTAGE DIRECT CURRENT (HVDC) **9**

HVDC system – Principle of operation, control and design consideration, HVDC circuit breaking.

UNIT IV FACTS **9**

Basic concepts – Reactive power control, uncompensated transmission line, series compensation, SVC, thyristor control, series capacitor, static synchronous compensator, unified power flow controller and applications.

UNIT V ELECTROSTATIC AND MAGNETIC FIELDS OF EHV LINES **9**

Electric shock – threshold currents – Calculation of electrostatic fields and magnetic fields of AC and DC lines – Effect of fields on living organism – Electrical field measurement.

TOTAL : 45 PERIODS

OUTCOMES:

- Expose to the components of electrostatic and magnetic field effects of EHV lines.

TEXT BOOKS

1. S Kamakshaiah& V Kamaraju “HVDC Transmission”, Tata McgrawHilll Publishers, 2011.
2. Rakosh Das Begamudre “ Extra high voltage AC transmission Engineering”, New Age International Publishers, Third Edition, 2006.
3. Narain G Hingorani“ Understanding FACTS” Standard Publishers, 1994.
4. P.Kundur“ Power System stability and control”, Tata McgrawHilll Publishers, 1994.

REFERENCES

1. C.L. Wadhwa“ Electrical Power Systems”, New Age International Publishers, Fourth Edition, 2005.
2. K.R. Padiyar, “ HVDC Power Transmission System”. New Age International Publishers, First Edition, Reprint 2005.
3. M.L. Soni, P.V. Gupta, U.S. Bhatnagar, A.Chakrabarti, “ A Text Book on Power System Engineering”, Dhanpat Rai & Co., 1998.
4. Mafen Abdel – Salam, Hussein Anis, Ahdab E-Moshedy, RoshdyPadwan “ High Voltage Engienering – Theory & Practice”, Marcel Dekker Inc., 2000.

PTEE7008 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LT P C
3 0 0 3

OBJECTIVES

- To enable the student to have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.
- To introduce the general instrument system, error, calibration etc.
- To explain the techniques for measurement of voltage and current.
- To explain the techniques for measurement of other electrical parameters namely power, energy, frequency, phase etc.
- To discuss the comparison methods of measurement.
- To give exposure to non-electrical measurements and data acquisition system.

UNIT I UNITS AND STANDARDS IN MEASUREMENT 9

Principle of measurement – absolute, comparative, direct reading and null balance methods. SI units - rules for display of results of a measurement – Systematic errors – accuracy- and random errors - precision index – peak (unipolar and bipolar) and standard deviations - statistical evaluation of measurement data - Gaussian distribution - Standards and calibration

UNIT II ANALOG AND INDICATING INSTRUMENTS 9

PMMC ammeter – range conversion – PMMC voltmeter – Figure of merit - moving iron ammeter – range conversion – MI voltmeter – Electrodynamometer type ammeter – Electrodynamometer type wattmeter – UPF, LPF types – Induction type energy meter - Single and three phase power and energy measurement.

UNIT III DIGITAL INDICATING INSTRUMENTS 9

Timer –counter – Dual slope DVM – Digital multi meter (DMM) – Digital energy meter (DEM)– DAC - ADCs - Data acquisition systems – PC based measurements.

UNIT IV NULL BALANCE METHODS OF MEASUREMENT 9

Potentiometer: - DC and AC – Wheatstone, Kelvin and Mega ohm bridges - A.C. bridges: Maxwell, Anderson, Hay, Wien and Schering.

UNIT V MISCELLANEOUS INSTRUMENTS 9

Q- meter – Instrument transformers – CRT and CRO – DSO - Multiple earth and earth loops – Grounding techniques - Electrostatic and electromagnetic interference - Measurement of pressure - temperature: thermocouple and RTD; Measurement of displacement: LVDT – Measurement of force: strain gauge – A.C. and D.C. tachometer – Digital transducers.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to implement and verify different measurement schemes for measuring of electrical and non-electrical parameters.

TEXT BOOKS:

1. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, New Delhi, Edition 2011.
2. A. D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall, 2007.
3. R.B. Northrop, ‘Introduction to Instrumentation and Measurements’, Taylor & Francis, New Delhi, 2008

REFERENCES:
1. M.M.S. Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009
2. J.J. Carr, 'Elements of Electronic Instrumentation and Measurement', Pearson Education India, New Delhi, 2011
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
4. E. O. Doebelin and D. N. Manik, " Measurement Systems – Application and Design", 6th Edition, Tata McGraw-Hill, New Delhi, 2011.

PTEE7009 EMBEDDED AUTOMATION SYSTEMS LT P C
3 0 0 3

OBJECTIVES
- To introduce different types of sensors used extensively in vehicle automation
- To understand the basic scheme for interfacing sensing and actuating component
- To focus on scope for embedded based secured environment for industrial and home automation

UNIT I INTRODUCTION TO SENSORS AND ACTUATORS 9

Sensor electronics and techniques – Overview of sensor measurements – Sensor linearization and characterization – Sensor classification - – sensors and actuators for automotive systems - .Air flow rate sensor – angular position sensor – engine speed sensor – torque, light, distance and level –Hall Effect position sensor – optical crank shaft sensor – throttle angle sensor – sensor for feedback control – automotive engine control actuators–sensor data acquisition.

UNIT II AUTOMOTIVE SYSTEM AND CONTROL 9

Basics of Electronic engine control system – Electronic Fuel Control System – Electronic ignition system- Digital Engine Control systems – Speed, EGR , Traction control- Functions and control – Vehicle motion control- Engine performance metric—BSFC, Power, Efficiency, Engine mapping, Air fuel ratio – Electronic Fuel Control—Electronic Ignition—Comparison with Hybrid vehicle Power train control .

UNIT III AUTOMOTIVE INSTRUMENTATION 9

Microcomputer based instrumentation system – advantages – signal conversion – multiplexing – sampling – Measurement of fuel, coolant temperature, oil pressure, speed –Principles of stepper motors, Relays , solenoids , Hydraulic and pneumatic devices-microcontrollers interface for Sensor and actuator circuit, Display devices – onboard diagnostics

UNIT IV BUILDING AUTOMATION 9

CAN Bus Network for vehicle Automation – Integrated vehicle electronic system – Telematics – Electronic control system diagnostics –Concept of energy management system, occupancy sensors, fans & lighting controller-Basics of virtual instrumentation-Digital field testers – test and calibration standards –traceability-EMI/EMC

UNIT V ADVANCES IN AUTOMOTIVE ELECTRONIC SYSTEMS 9

Introduction to electric and hybrid vehicles – Fuel cells powered vehicles – Safety and Collision Avoidance – Navigation support for vehicles – Automatic unmanned driving control for vehicles.

TOTAL: 45 PERIODS

OUTCOMES:
- Able to design an efficient embedded automation system for vehicles.

TEXT BOOKS

1. William B. Ribbens, Understanding Automotive Electronics, 6th edition, YES DEE Publishing Private Limited, 2011.
2. Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill, 2007.

REFERENCES

1. Al Santini, ' Automotive Technology', Cengage Learning edition 2004.
2. Ali Emadi, 'Vehicular Electric Power Systems', Marcel Dekkeredition 2004
3. MehrdadEhsani, 'Modern Electric, Hybrid Electric and Fuel cell vehicles', CRC Press Second edition 2011.
4. BarneyCapehart,'WebBasedEnterpriseEnergyandBuildingAutomationSystems',C.E.M, Editor.
5. E Q Doebelin, Measurement Systems, Application and Design, 4th edition, McGraw-Hill, 2011.
6. Uwe Kiencke, Lars Nielsen, "Automotive Control Systems: For Engine, Driveline, and Vehicle", Springer; First edition, 2000.

PTEE7010 EMBEDDED SYSTEM DESIGN LT P C
3 0 0 3

OBJECTIVES

To provide a clear understanding on the basic concepts of embedded system design and its applications to various fields:

- Building Blocks of Embedded System
- Introduction to Embedded software Tools
- Bus Communication protocol, Input/output interfacing.
- Various scheduling concepts for process &basics of Real time operating system.
- Discussions through Phases of development of embedded products.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems – The build process for embedded systems- Structural units for an Embedded microcontroller , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock-- IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, Boundary Scan

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols -RS232 standard – RS485 – USB Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C)

UNIT III INTERRUPTS SERVICE MECHANISM AND DEVICE DRIVERS 9

Programmed-I/O busy-wait approach without interrupt service mechanism-ISR concept-interrupt sources – multiple interrupts – context and periods for context switching, interrupt latency and deadline – Introduction to Device Drivers

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Pre-emptive and non-pre-emptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of commercial Real time Operating systems: Vx Works, чC/OS-II, RT

Linux

UNIT V EMBEDDED SYSTEM APPLICATION WITH DEVELOPMENT 9

Case Study: Washing Machine- Automotive Application-Embedded Product Development Life Cycle, Objective, Need, and different Phases & Modelling of the EDLC

TOTAL:45 PERIODS

OUTCOMES:

- Able to understand the hardware and software functional required to design automation for an embedded process.

TEXT BOOKS

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. Peckol, "Embedded system Design",JohnWiley&Sons,2010

REFERENCES

1. Shibu.K.V, "Introduction to Embedded Systems", Tata McGraw Hill,2009
2. LyaB. Das," Embedded Systems",Pearson Education,2010.
3. Elica White, 'Making Embedded Systems', O'Reilly Series,SPD,2011
4. Dave, "Embedded Systems: Concepts Design and Programming,1st edition, Pearson Education,2015.
5. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006
6. Jonathan W. Valvano, 'Embedded Microcomputer Systems Real time Interfacing', Cengage learning , 3rd edition ,2012
7. Han-Way Huang, "Embedded system Design using C8051", Cengage Learning,2009

PTEE7011 ENERGY MANAGEMENT AND AUDITING L T P C
3 0 0 3

COURSE OBJECTIVES

- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I INTRODUCTION 9

Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting-energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation

Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

TOTAL:45 PERIODS

TEXT BOOKS

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,. Logman Scientific & Technical, ISBN-0-582-03184, 1990.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.

PTEE7012 FLEXIBLE AC TRANSMISSION SYSTEMS LT P C
3 0 0 3

OBJECTIVES

- To expose the students to the start-of-art of the power system
- To analyze the performance of power systems with FACTS controllers.
- To model FACTS controllers for load flow and dynamic analysis

UNIT I INTRODUCTION 9

Reactive power control in electrical power transmission lines–loads & system compensation-Uncompensated transmission line–shunt and series compensation. Basic concepts of Static Var Compensator (SVC)–Thyristor Controlled Series Capacitor (TCSC) –Unified Power Flow Controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage–Design of SVC voltage regulator–Modelling of SVC for power flow and fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variable reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNITIV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies.

UNITV CO-ORDINATION OF FACTS CONTROLLERS 9

Controllerinteractions–SVC–SVCinteraction–Co-ordinationofmultiplecontrollersusing linear control techniques –Control co-ordination using genetic algorithms.

TOTAL:45 PERIODS

OUTCOMES:

- Able to understand, analyse and develop analytical model of FACTS controller for power system application.

TEXTBOOKS

1. R.MohanMathur,RajivK.Varma,"Thyristor–BasedFactsControllersforElectrical Transmission Systems", IEEE press andJohnWiley&Sons,Inc,2002.
2. Narain G.Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors,Delhi-110006,2011.

REFERENCES

1. K.R.Padiyar,"FACTSControllersinPowerTransmissionandDistribution",NewAgeInternational (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,"FlexibleA.C.TransmissionSystems",InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.

PTEE7013 FUNDAMENTALS OF COMPUTER ARCHITECTURE LT P C
3 0 0 3

OBJECTIVES

To understand the basic concepts and organization of Computers

- To understand the basic concepts and organization of Computers.
- To study implementation of combinational circuits, the design of various synchronous and asynchronous circuitry supportive to CPU operation.
- To introduce various memory devices, Significances of Memory management.
- Introduce the CPU architecture, micro programming and peripheral interfacing.
- Concepts and importance of parallelism through various processor technologies

UNIT I BASIC STRUCTURE OF COMPUTING PROCESSORS 9

Functional units –Number system, error detection, corrections & codes conversions, Binary Arithmetic, Boolean algebra: Basic operational concepts. Design of adder, subtractor,

comparators, code converters, encoders, decoders, multiplexers and demultiplexers.

UNIT II DIGITAL CIRCUIT DESIGN 9

Flip flops - SR, D, JK and T, shift registers, counters, state assignments analysis and design of synchronous sequential circuits, state diagram; state reduction-Analysis of asynchronous sequential machines, state assignment, asynchronous design problem.

UNIT III CONTROL AND CENTRAL PROCESSING UNIT 9

Micro programmed control –design of control unit- Central processing unit – general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, execution of instruction set in computer–concepts in design of addition and subtraction, multiplication algorithms for arithmetic operations-Memory organization – ROM, PROM, EPROM, cache memory, need for memory management .

UNIT IV INPUT OUTPUT ORGANIZATION 9

Input output organization: peripheral devices, input output interface, asynchronous data transfer, Bus arbitration – Instruction and instruction sequencing –modes of transfer, interrupt service, input output interface, communication ports-need for Serial BUS-RS232,Ethernet Bus, Parallel port communication- ISA, PCI

UNIT V PIPELINE AND PARALLELISM IN COMPUTER PROCESSORS 9

Parallel Processing-- Pipelining-Arithmetic Pipeline—Instruction Pipeline—Introduction to Vector processors and Array processors.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand the architecture and various components of computer hardware system. Introduction to functions of various types of digital circuits are analysed and studied as building blocks of a computation processor.

TEXT BOOKS

1. Morris Mano, ‘Computer system architecture’, 3rd edition, Pearson education 2007
2. Thomas L. Floyd, ‘Digital Fundamentals’, Tenth Edition, Pearson education 2010
3. William Stallings, ‘Computer Organization and architecture’, 7th edition Pearson Education 2011

REFERENCES

1. Behrooz Parhami, ‘Computer Architecture’, Oxford University Press, 2005.
2. Vincent P. Heuring and Harry F. Jordan, ‘Computer systems design and architecture’ Pearson Education Asia Publications, 2004.
3. Charles H.Roth,Jr., ’Fundamentals of Logic Design’, Cengage Learning Fifth Edition, 2012

PTEE7014 FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING LT P C
3 0 0 3

OBJECTIVES

To introduce the concept of Object Oriented Programming and C++.

- Familiar with the concepts of Object Oriented Programming.
- Able to appreciate the features of C++ programming Language.
- Having a thorough understanding about Classes and Objects.
- Able to develop programs in C++

UNIT I INTRODUCTION TO OBJECT-ORIENTED PROGRAMMINGAND C++ 10

Procedure-Oriented Programming System – Object-Oriented Programming System – Comparison of C++with C–Object-Oriented Terms and Concepts–Object-Oriented Languages – Differences between Procedural and Object-Oriented Programming – Merits and Demerits of Object-Oriented Methodology. Structure of a C++ Program–Data Types– Operators in C++ - Control Structures – Functions in C++

UNIT II CLASSESAND OBJECTS 8

Introduction to Classes and objects – Member Functions and Member Data – Objects and Functions–Objects and Arrays–Name Spaces–Nested Classes–Dynamic Memory Allocation and Deallocation – Constructors and Destructors

UNIT III INHERITANCEAND POLYMORPHISM 9

Introduction – Base Class and Derived Class Pointers – Function Overriding – Base Class Initialization–Protected Access Specifier–Deriving by Different Accessing specifiers– Different Kinds of Inheritance – Order of Invocation of Constructors and Destructors – Virtual Functions – Mechanism of Virtual Functions – Pure Virtual Functions–Virtual Destructors and Constructors

UNIT IV OPERATOR OVERLOADING, TEMPLATES 9

Operator Overloading–Overloading of various Operators– Type Conversion–New Style Casts and the typed Operator–Function Templates–Class Templates– The Standard Template Library (STL)

UNIT V EXCEPTION HANDLINGAND CASE STUDIES 9

Introduction–C-Style Handling of Error-generating Code–C++-Style Solution-the try/ throw/ catch Construct–Limitations of Exception Handling. Case Studies: String Manipulations– Building classes for matrix operations

TOTAL:45 PERIODS

OUTCOMES:

- Ability to develop the object oriented programs for simple projects

TEXT BOOKS

1. SouravSahay,"ObjectOrientedProgrammingwithC++",OxfordUniversityPress,2006.
2. Deittel and Deittel, "C++ - How to Program", 2nd Edition, Prentice Hall of India.
3. Balagurusamy E. ,"Object Oriented Programming with C++",3rd Edition, Tata McGraw Hill, 2007

REFERENCES

1. K U Subhash, " Object Oriented Programming with C++", Pearson, 2010.
2. Bhushan Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.

3. IraPohl, “Object Oriented Programming using C++”,Pearson Education,2nd Edition, 2003
4. John P. Hayes , ‘ Computer Architecture and Organization’, Tata McGraw-Hill, 1988.
5. Andrew S Tannenbaum ‘Structured Computer Organization‘,5thedition Pearson Education 2007

PTEE7015 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION LT P C
3 0 0 3

OBJECTIVES

To understand the concept, planning of DC power transmission and comparison with AC power transmission.

- To analyse HVDC converters.
- To study about the HVDC system control.
- To analyse harmonics and design of filters.
- To model and analysis the DC system under study state.

UNITI INTRODUCTION 9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems

UNITII ANALYSIS OF HVDC CONVERTERS 9

Line commutated converter - Analysis of Graetz circuit with and without overlap - Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysisofa 12 pulse converters– Analysis of VSC topologies and firing schemes

UNITIII CONVERTERANDHVDCSYSTEMCONTROL 9

Principles of DC link control–Converter control characteristics–System control hierarchy– Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

UNITIV REACTIVE POWER AND HARMONICS CONTROL 9

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters

UNITV POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

TOTAL:45 PERIODS

OUTCOMES:

- Basic principles and types of HVDC system are studied.
- Features of converters used in HVDC system are studied.
- Concepts and reactive power management, harmonics and power flow analysis are studied.

TEXTBOOKS

1. Padiyar,K.R.,"HVDCpowertransmission system",New Age International(P)Ltd.NewDelhi,Second Edition,2010.
2. Edward Wilson Kimbark," Direct Current Transmission", Vol.I,Wiley inter science, New York, London, Sydney,1971.

REFERENCES

1. Kundur P.," Power System Stability and Control", McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG," High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
3. Arrillaga,J.,"HighVoltageDirectCurrentTransmission",PeterPregrinus,London,1983.

PTEE7016 INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN LT P C

3 0 0 3

OBJECTIVES

- To know the Industrial power quality standards
- To know mitigation techniques for harmonics and flicker problem

UNIT I MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited Capacity Generators-Computer-Aided Analysis.

UNIT II POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modelling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Over voltages-Switching Surge Analysis-Back-to-Back Switching.

UNIT III HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study.

UNIT IV FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects.

UNIT V GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

TOTAL : 45 PERIODS

OUTCOMES:

- Different standards of power quality are studied.
- Features of different PF correction studies, harmonic analysis and flicker analysis and grid analysis are studied.

TEXT BOOKS

1. Ramasamy Natarajan, "Computer-Aided Power System Analysis", Marcel Dekker Inc., 2002.
2. Sen, S.K. "Principles of Electrical machine Designs with Computer Programmes." Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987

REFERENCES
1. A.Shanmugasundara, G. Gangadharan, R. Palani " Electrical machine Design Date Book'" New Age International Pvt. Ltd., Reprint 2007.
2. Balbir Singh "Electrical Machine Design" Brite Publications, Pune, 1981.

PTEE7017 MEDICAL INSTRUMENTATION LT P C
3 0 0 3

OBJECTIVES:
- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues – Basic mechanics of spinal column and limbs - Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements .

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography– Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart–Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopaedic prostheses fixation.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Second Edition, Boca Raton, CRC Press LLC, 2000

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 1997.
3. Joseph J.Carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 1997.
4. Khandpur R S, Handbook of Medical Instrumentation, Tata Mc Graw Hill.
5. Duane Knudson, Fundamentals of Biomechanics, Springer, 2003.
6. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.

PTEE7018 MICRO ELECTRO MECHANICAL SYSTEMS LT P C
3 0 0 3

OBJECTIVES

- To introduce MEMS technology
- To study the different MEMS materials and their properties
- To study the different fabrication process used in MEMS technology.
- To introduce the fundamental working principles of different micro sensors and actuators.

UNIT I INTRODUCTION 9

Intrinsic Characteristics of Micro systems – Energy Domains and Transducers- Sensors and Actuators – Silicon based MEMS processes – MEMS Materials –Review of Electrical and Mechanical concepts in MEMS – Introduction to Micro system Fabrication processes

UNIT II MICROMACHINING 9

Bulk Micromachining - Surface micromachining and LIGA processes

UNIT III SENSORS AND ACTUATORS - I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Micro motors –Inter digitated Finger capacitor – Comb drive devices – Thermal Sensing and Actuation – Thermal expansion– Thermal couples – Thermal resistors – Applications – Magnetic Actuators – Micro magnetic components – Case studies of MEMS in magnetic actuators.

UNIT IV SENSORS AND ACTUATORS - II 9

Piezo resistive sensors – Piezo resistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT V APPLICATIONS 9

Application to Acceleration, Pressure, Flow, Chemical, Inertial sensors - Optical MEMS – Bio MEMS – RF MEMS – Energy Harvesting – NEMS devices

TOTAL : 45 PERIODS

OUTCOMES:

- Able to design and analyse the performance of MEMS devices.
- Able to identify the right MEMS device against the applications.

TEXT BOOKS.

1. Stephen D Senturia, “Micro system Design”, Springer International Edition, 2006.
2. Tai Ran Hsu, “MEMS and Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2006.
3. N.P. Mahalik, “ MEMS”, Tata McGraw-Hill, New Delhi, 2007

REFERENCES

1. Marc Madou, “Fundamentals of Micro fabrication”, CRC press, 2002.
2. Gregory T. Kovacs “Micro machined Transducers Source Book”, McGraw-Hill High Education, 1998.
3. M.H.Bao, “Micromechanical Transducers: Pressure sensors, Accelerometers and Gyroscopes”, Elsevier, Newyork, 2000.
4. Chang Liu, “Foundations of MEMS”, Pearson Education Inc., 2006

PTEE7019 NANO TECHNOLOGY LT P C
3 0 0 3

OBJECTIVES

- To introduce the concept and knowledge of Nano science and Nanotechnology.
- To know about preparation methods and nanofabrication techniques.
- To create awareness of clean room environment & societal implications of Nanotechnology
- To know about the different characterization techniques used for Nano systems

UNIT I INTRODUCTION 10

Nano scale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of bulk nano structured materials- Nano particles- quantum dots, nano wires-ultra-thin films – multilayered materials, Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties

UNIT II PREPARATION ENVIRONMENTS 5

Clean rooms: specifications and design, air and water purity, requirements for particular Processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological Contamination, Safety issues, flammable and toxic hazards, biohazards, implication of Nano science and Nanotechnology on society.

UNIT III PREPARARTION ROUTES AND LITHOGRAPHY FOR NANOSCALEDEVICES **10**

Preparation of nanoscale materials: precipitation, mechanical milling, colloidal routes, self assembly; vapour phase deposition, CVD, sputtering, evaporation, molecular beam epitaxy, atomic layer epitaxy, lithography: optical/UV, electron beam and x-ray lithography, systems and processes, wet etching, dry etching

UNIT IV CHARECTERIZATION TECHNIQUES **10**

X-ray and Neutron diffraction technique, Scanning Electron Microscopy plus environmental techniques, Transmission Electron Microscopy including high-resolution imaging, analytical electron microscopy, EDX and EELS, Surface Analysis techniques, XPS, SIMS, Auger

UNIT V EVOLVING INTERFACES OF NANO **10**

Applications of nanotechnology: NEMS – Nanosensor – nanomedicines - nanotechnology Applications to electrical engineering –Nanoelectronics: quantum transport devices, molecular electronics devices, quantum computing ,memory, CNT and its applications, Nano motor, Nano robot, energy efficient battery technology, Nano dielectrics, lighting system, solar cell

TOTAL:45 PERIODS

OUTCOMES:

- To understand unique properties of Nano material structure and apply them for Electrical and Electronics Engineering.

TEXT BOOKS

1. Chattopadhyay K.K and A.N Banerjee, Introduction to Nanoscience and nanotechnology, PHI, 2009
2. T. Pradeep, Nano the essentials, Tata-McGraw Hill Education, 2007

REFERENCES

1. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999.
2. Charles P.Poole & Frank ,J.Owens,Introduction to nanotechnology ,WileyIndia.
3. Jan Korwink and Andreas Greiner, Semiconductors for Micro and Nanotechnology: An Introduction for Engineers, Weinheim Cambridge: wiley-VCH,2001.
4. Rainer wager(ed), Nano Electronics and Information Technology,2nd Edition, Wiley-VCH
5. N. John Dinardo, Nanoscale Characterization of Surfaces and Interfaces, Second edition, Weinheim Cambridge: wiley-VCH,2000
6. B S Murthy,P Shankar, Baldev Raj, BB Rath& James Murday.'Text book of Nanoscience and Nano Technology',,Universities Press, 2011.

PTEE7020 OPERATIONAL RESEARCH LT P C
3 0 0 3

OBJECTIVES

- To learn the basics of optimization techniques and their applications to Electrical Engineering

UNIT I LINEAR PROGRAMMING 9

Introduction - formulation of linear programming model - Graphical solution – solving LPP using simplex algorithm – Revised Simplex Method

UNIT II ADVANCES IN LPP 9

Duality theory - Dual simplex method - Sensitivity analysis –- Transportation problems – Assignment problems- Traveling sales man problem -Data Envelopment Analysis

UNIT III NON LINEAR PROGRAMMING 9

Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions – Reduced gradient algorithms – Quadratic programming method – Penalty and Barrier method.

UNIT IV INTERIOR POINT METHODS 9

Karmarkar's algorithm – Projection Scaling method –Dual affine algorithm – Primal affine algorithm Barrier algorithm.

UNIT V DYNAMIC PROGRAMMING 9

Formulation of Multistage decision problem – Characteristics – Concept of sub-optimization and the principle of optimality – Formulation of Dynamic programming – Backward and Forward recursion – Computational procedure – Conversion of final value problem into Initial value problem.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply the optimization technique for electrical engineering applications.

TEXT BOOKS

1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000
2. R.Panneer selvam, "Operations Research", PHI, 2006

REFERENCES

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
2. Hamdy A Taha, "Operations Research – An Introduction", Prentice Hall India, 2003.
3. Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd. New Delhi, 2005.

PTEE7021 POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS **L T P C**
3 0 0 3

OBJECTIVES

- To study the features of different elements used in renewable energy conversion.
- To study the hybrid operation of wind and PV systems.
- To study the features of MPPT tracking.

UNIT I INTRODUCTION **9**

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION **9**

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS **9**

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing

Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS **9**

Standalone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS **9**

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

OUTCOMES:

- Features of renewable energy sources are studied.
- Features of electrical machines and converters used in renewable energy conversion are studied.
- Wind and PV systems are analysed and its hybrid operation is successfully studied.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press 2005.

REFERENCES:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993.
4. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.
5. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi,2011.

PTEE7022 **POWER QUALITY** **LT P C**
3 0 0 3

OBJECTIVES

- To study the causes & Mitigation techniques of various PQ events
- To study various Active & Passive power filters.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuation - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve

UNIT II VOLTAGE SAGS AND SWELLS 9

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sags, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swells.

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortion - Harmonic indices - Inter harmonics – Resonance - Harmonic distortion evaluation, IEEE and IEC standards

UNIT IV PASSIVE POWER COMPENSATORS 9

Principle of Operation of Passive Shunt and Series Compensators Analysis and Design of Passive Shunt Compensators Simulation, and Performance of Passive Power Filters Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyser - Flicker meters - Disturbance analyser - Applications of expert systems for power quality monitoring. Principle& Working DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

TOTAL: 45 PERIODS

OUTCOMES

- Students learn about the various sources, causes, effects and understand the monitoring techniques and preventive measures of different Power quality issues in electrical systems.

TEXT BOOKS

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.Wayne Beaty, "Electrical Power Systems Quality", McGraw Hill,2003
2. J. Arrillaga, N.R. Watson, S. Chen, "Power System Quality Assessment", (New York: Wiley),2000.

REFERENCES

1. G.T. Heydt, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.
2. M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”,(New York: IEEE Press),2000.
3.Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” (New York: Wiley), Reprint 2015.

PTEE7023 RESTRUCTURED POWER SYSTEMS LT P C
3 0 0 3

COURSEOBJECTIVES

- To introduce there structuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To Illustrate about various power sectors in India

UNITI INTRODUCTIONTO RESTRUCTURINGOFPOWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems–Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production– Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis–a–vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSIONCONGESTIONMANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management–Classification of congestion management methods–Calculation of ATC-Non market methods–Market methods–Nodal pricing–Inter zonal and Intra zonal congestion management–Price area congestion management–Capacity alleviation method.

UNIT III LOCATIONALMARGINALPRICESANDFINANCIAL TRANSMISSION RIGHT 9

Mathematical preliminaries:-Locational marginal pricing Lossless DCOPF model for LMP calculation Loss compensated DCOPF model for LMP calculation ACOPF model for LMP calculation–Financial Transmission rights–Risk hedging functionality Simultaneous feasibility test and revenue adequacy–FTR issuance process: FTR auction, FTR allocation–TreatmentofrevenueshortfallSecondarytradingofFTRs–Flow gate rights–FTR and market power-FTR and merchant transmission investment.

UNIT IV ANCILLARYSERVICEMANAGEMENTANDPRICINGOFTRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services Classification of Ancillary services–Load generation balancing related services Voltagecontrolandreactivepowersupportdevices–Blackstartcapabilityservice-How to obtain ancillary service –Co-optimization of energy and reserve services- International comparison Transmission pricing –Principles– Classification– Rolled in transmission pricing methods–Marginaltransmissionpricingparadigm–Compositepricingparadigm–Merits and demerits of different paradigm.

UNIT V REFORMSININDIAN POWER SECTOR 9

Introduction–Frame work of Indian power sector–Reform initiatives-Availability based tariff Electricity act 2003–Open access issues–Power exchange–Reforms in the near future

TOTAL : 45 PERIODS

OUTCOMES

- Learners will have knowledge on restructuring of power industry, basics of congestion management and also have enriched with the significance ancillary services and pricing of transmission network and various power sectors.

TEXT BOOKS

1. Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, "Restructured electrical power systems: operation, trading andvolatility" Pub.,2001
2. Kankar Bhattacharya, Jaap E.Daadler,MathH.J.Boolen," Operation of restructured power systems",Kluwer AcademicPub.,2001.

REFERENCES

1. SallyHunt,"Making competition work inelectricity",,JohnWilleyandSonsInc.2002
2. StevenStoft, "Power system economics: designing markets for electricity", John Wiley&Sons,2002.

PTEE7024 SMART GRID L T P C
3 0 0 3

COURSE OBJECTIVES

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES (Transmission) 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control.

UNIT III SMART GRID TECHNOLOGIES (Distribution) 9

DMS, Volt/VAr control,Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT IV SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband

over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

OUTCOMES

- Students will develop more understanding on the concepts of Smart Grid and its present developments.
- Students will study about different Smart Grid technologies.
- Students will acquire knowledge about different smart meters and advanced metering infrastructure.
- Students will have knowledge on power quality management in Smart Grids
- Students will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

TEXT BOOKS

1. Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions",CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.

REFERENCES*:*

1. Vehbi C. Güngör*,* DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella*,* Carlo Cecati*,* and Gerhard P. Hancke*,* Smart Grid Technologies: Communication Technologies and Standards IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids.

PTEE7025 SOFT COMPUTING TECHNIQUES L T P C

3 0 0 3

OBJECTIVES

- To study the basics of artificial neural network.
- To study the concepts of modelling and control of neural and fuzzy control schemes.
- To study the features of hybrid control schemes.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back propagation algorithm (BPA) – Recurrent neural network (RNN) – Adaptive resonance theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– Introduction to GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to support vector machine – Particle swarm optimization – Case study – Familiarization with ANFIS toolbox

TOTAL: 45 PERIODS

OUTCOMES:

- Basic concepts of ANN , different features of fuzzy logic and their modelling, control aspects; different hybrid control schemes are studied through practice.

TEXTBOOKS

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

PTEE7026 SPECIAL ELECTRICAL MACHINES LT P C
3 0 0 3

OBJECTIVES:

- To explore the theory and applications of special electrical machines.
- To review the fundamental concepts of permanent magnets and the operation of permanent magnet brushless DC motors.
- To introduce the concepts of permanent magnet brushless synchronous motors and synchronous reluctance motors.
- To develop the control methods and operating principles of switched reluctance motors.
- To introduce the concepts of stepper motors and its applications.
- To understand the basic concepts of other special machines.

UNIT I PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Characteristics and control

UNIT II PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – EMF and torque equations - Phasor diagram - Power controllers– performance characteristics – Digital controllers – Constructional features, operating principle and

characteristics of synchronous reluctance motor.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features –Principle of operation- Torque prediction –performance Characteristics- Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT IV STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque equation – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear induction motor – Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Need for special electrical machines are studied. Different features of special machines and converter circuits for special machines are obtained

TEXT BOOKS:

1. T.J.E. Miller, Brushless magnet and Reluctance motor drives, Claredon press, London, 1989.
2. R.Krishnan, Switched Reluctance motor drives, CRC press, 2001.
3. T.Kenjo, Stepping motors and their microprocessor controls, Oxford University press, New Delhi, 2000.
4. K. Venkataratnam **,**Special Electrical Machines, Universities Press, 2014.

REFERENCES:

1. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon press, London, 1988.
2. R.Krishnan, Electric motor drives, Prentice hall of India, 2002.
3. D.P.Kothari and I.J.Nagrath, Electric machines, Tata Mc Graw hill publishing company, New Delhi, Third Edition, 2004.
4. Irving L.Kosow, Electric Machinery and Transformers, Pearson Education, Second Edition, 2007.

PTEE7027 VLSI DESIGN AND ARCHITECTURE LT P C
3 0 0 3

OBJECTIVES

To understand the basic concepts of VLSI and CMOS design.

- Introduce the basics of VLSI design and its importance.
- Analyse the switching Characteristics of MOS transistor.
- Study the construction of NMOS, CMOS and Bi-CMOS based logic circuits.
- To learn about the programming of Programmable device using Hardware description Language.

UNIT I BASIC MOS TRANSISTOR 9

Introduction to logic design –switching devices- MOS transistor current equation – second order effects – MOS Transistor Model- Fabrication Technologies (NMOS, PMOS, CMOS, BiCMOS).

UNIT II NMOS & CMOS GATES 9

NMOS & CMOS inverter – Determination of pull up / pull down ratios – CMOS based logic design- stick diagram – lambda based rules – super buffers – BiCMOS .

UNIT III SUB SYSTEM DESIGN & LAYOUT 9

Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

UNIT IV DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAYLOGIC 9

Programmable Logic Devices- PLA, PAL, GAL, CPLD, FPGA–- Implementation of Finite State Machine with PLDs

UNIT V VHDL PROGRAMMING 9

RTL Design – Structural level Design -combinational logic – Types – Operators – Packages– Sequential circuit – Sub programs – Test benches. (Examples: adder, counters, flip flops, FSM, Multiplexers / Demultiplexers).

TOTAL:45 PERIODS

OUTCOMES

- Expose to HDL language and ability to design PLD devices and simple application.

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New Delhi, 2003.
2. Debprasad Das, VLSI Design, Oxford University Press, 2010.
3. Eugene D.Fabricius, 'Introduction to VLSI Design', Tata McGraw Hill, 1990.

REFERENCES

1. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Education, India, 2002.
2. Charles H.Roth, 'Fundamentals of Logic Design', Jaico Publishing House, 1992.
3. Zainalatsedin Navabi, 'VHDL Analysis and Modelling of Digital Systems', 2n Edition, Tata McGraw Hill, 1998.
4. Douglas Perry, 'VHDL Programming By Example', Tata McGraw Hill, 3rdEdition.2007.
5. Parag K.Lala, 'Digitl System Design using PLD', BS Publications, 2003

PTCS7071 OPERATING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To learn the concepts of operating systems.
- To learn about the various issues in operating systems.
- To familiarize with the important mechanisms in operating systems.
- To appreciate the emerging trends in operating systems.

UNIT I OPERATING SYSTEMS OVERVIEW 9

Introduction to operating systems – Computer system organization, architecture – Operating system structure, operations – Process, memory, storage management – Protection and security – Distributed systems – Computing Environments – Open-source operating systems – OS services – User operating-system interface – System calls – Types – System programs – OS structure – OS generation – System Boot – Process concept, scheduling – Operations on

processes – Cooperating processes – Inter-process communication – Examples – Multithreading models – Thread Libraries – Threading issues – OS examples.

UNIT II PROCESS MANAGEMENT 9

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple-processor scheduling – Operating system examples – Algorithm Evaluation – The critical-section problem – Peterson's solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9

Memory Management – Swapping – Contiguous memory allocation – Paging –Segmentation – Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing**.**

UNIT IV I/O SYSTEMS 9

File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection.

UNIT V CASE STUDY 9

The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication – Network Structure – Security – Windows 7 – History – Design Principles – System Components – Terminal Services and Fast User – File system – Networking.

TOTAL: 45 PERIODS

OUTCOMES:

On Completion of the course, the students should be able to:

- Articulate the main concepts, key ideas, strengths and limitations of operating systems
- Explain the core issues of operating systems
- Know the usage and strengths of various algorithms of operating systems

TEXT BOOK:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts Essentials", John Wiley & Sons Inc., 2010.

REFERENCES:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
2. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
3. D M Dhamdhere, "Operating Systems: A Concept-based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
4. William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition, Prentice Hall, 2011.

PTEI7651 INDUSTRIAL DATA COMMUNICATION LT P C
3 0 0 3

COURSE OBJECTIVES

- To give an overview of the Industrial data communications systems.
- To provide a fundamental understanding of common principles, various standards, protocols.
- To provide insight into some of the new principles those are evolving for future networks.

UNIT I DATA NETWORK FUNDAMENTALS 9

EIA 232 interface standard – EIA 485 interface standard – ISO/OSI Reference model – Media access protocol: Command/response, Token passing and CSMA/CD – TCP/IP – Bridges – Routers – Gateways – Standard ETHERNET Configuration

UNIT II MODBUS AND HART 9

MODBUS: protocol structure, Function codes. Evolution of signal standard: HART communication protocol – Communication modes – HART Networks – HART commands – HART applications – Troubleshooting

UNIT III PROFIBUS AND FF 9

Fieldbus: Introduction – General Fieldbus architecture – Basic requirements of Fieldbus standard – Fieldbus topology – Interoperability and Interchangeability. Profibus: Introduction – Profibus protocol stack – Profibus communication model – Communication objects – Foundation field bus versus Profibus.

UNIT IV AS – INTERFACE (AS-i), DEVICENET AND INDUSTRIAL ETHERNET 9

AS interface: Introduction – Physical layer – Data link layer – Operating characteristics. Device net: Introduction – Physical layer – Data link layer and Application layer.
Industrial Ethernet: Introduction – 10Mbps Ethernet – 100Mbps Ethernet.

UNIT V WIRELESS COMMUNICATION 9

Wireless sensor networks: Hardware components – energy consumption of sensor nodes – Network architecture – sensor network scenario. Wireless HART – Existing Wireless Options: IEEE 802.15.4 - ISA 100 – Zigbee – Bluetooth **–** their relevance to industrial applications

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Gain knowledge on various industrial data communication networks, protocols and their selection.
2. Able to select and use most appropriate networking technologies and standards for a given application.
3. Ability to design and ensuring that best practice is followed in installing and commissioning the data communications links to ensure they run fault-free.
4. Ability to understand requirements of industrial application and provide wired or wireless solution.

TEXT BOOKS:

1 Mackay, S., Wright,E., Reynders,D., and Park,J., “Practical Industrial Data Networks: Design, Installation and Troubleshooting”, Newnes Publication, Elsevier, 2004.

2 Buchanan,W., “Computer Busses: Design and Application”, CRC Press, 2000.

REFERENCES:

1 Bowden,R., “HART Application Guide”, HART Communication Foundation, 1999.

2 Bela G.Liptak, “Instrument Engineers’ Handbook, Volume 3 : Process Software and Digital Networks”, 4th Edition, CRC Press, 2011.

3 Berge,J., “Field Buses for Process Control: Engineering, Operation, and Maintenance”, ISA Press, 2004.

4 Lawrence (Larry) M. Thompson and Tim Shaw, “Industrial Data Communications”, 5th Edition, ISA Press, 2015.

5. NPTEL Lecture notes on, ”Computer Networks” by Department of Electrical Engg., IIT Kharagpur.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	F	g	h	i	j	k	l
1	✓											
2		✓										
3				✓								
4					✓							
5												

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2017
B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING (PART-TIME)

Educational Objectives

Bachelor of Electronics and Instrumentation Engineering curriculum for part-time is designed to prepare the graduates having attitude and knowledge to

1. Have successful technical and professional careers in their chosen fields such as Process Control, Electronics & Information Technology.
2. Engross in life long process of learning to keep themselves abreast of new developments in the field of Electronics & Instrumentation

Programme Outcomes

The graduates will have the ability to

a. Apply the Mathematical knowledge and the basics of Science and Engineering to solve the problems pertaining to Electronics and Instrumentation Engineering.
b. Identify and formulate Instrumentation Engineering problems from research literature and be able to analyze the problem using first principles of Mathematics and Engineering Sciences.
c. Come out with solutions for the complex problems and to design system components or process that fulfill the particular needs taking into account public health and safety and the social, cultural and environmental issues.
d. Draw well-founded conclusions applying the knowledge acquired from research and research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significant conclusion.
e. Form, select and apply relevant techniques, resources and Engineering and IT tools for Engineering activities like electronic prototyping, modeling and control of systems/processes and also being conscious of the limitations.
f. Understand the role and responsibility of the Professional Instrumentation Engineer and to assess societal, health, safety issues based on the reasoning received from the contextual knowledge.
g. Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for sustainable Development.
h. Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities.
i. Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
j. Communicate efficiently the engineering facts with a wide range of engineering community and others, to understand and prepare reports and design documents; to make effective presentations and to frame and follow instructions.
k. Demonstrate the acquisition of the body of engineering knowledge and insight and Management Principles and to apply them as member / leader in teams and multidisciplinary environments.
l. Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

PEO \ PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
2	✓	✓	✓	✓	✓	✓	✓				✓	✓

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS – 2017

B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING (PART-TIME)

CURRICULUM AND SYLLABI I TO VII SEMESTERS

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTPH7151	Engineering Physics	3	0	0	3
3.	PTCY7151	Engineering Chemistry	3	0	0	3
4.	PTGE7151	Computing Techniques	3	0	0	3
5.	PTEI7101	Electronics for Analog Signal Processing I	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI7201	Electrical and Electronic Measurements	3	0	0	3
2.	PTEI7202	Electronics for Analog Signal Processing II	3	0	0	3
3.	PTEI7203	Instrument Transducers	3	0	0	3
4.	PTEI7204	Signals and Systems	3	0	0	3
PRACTICALS						
5.	PTEI7211	Sensors and Signal Conditioning Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI7301	Control Systems	3	0	0	3
2.	PTEI7302	Digital Principles and Applications	3	0	0	3
3.	PTEI7303	Industrial Instrumentation I	3	0	0	3
4.	PTEI7304	Microprocessors, Microcontrollers and Applications	3	0	0	3
PRACTICALS						
5.	PTEI 7311	Microprocessor and Interfacing Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI7401	Analytical Instruments	3	0	0	3
2.	PTEI7402	Industrial Instrumentation II	3	0	0	3
3.	PTEI7403	Process Control	3	0	0	3
4.		Elective I	3	0	0	3
PRACTICALS						
5.	PTEI 7411	Process Control and Instrumentation Laboratory I	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI7501	Industrial Instrumentation III	3	0	0	3
2.	PTEI7502	Logic and Distributed Control System	3	0	0	3
3.		Elective II	3	0	0	3
4.		Elective III	3	0	0	3
PRACTICALS						
5.	PTEI 7511	Process Control and Instrumentation Laboratory II	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI7601	Thermal Power Plant Instrumentation	3	0	0	3
2.	PTEI7651	Industrial Data Communication	3	0	0	3
3.		Elective IV	3	0	0	3
4.		Elective V	3	0	0	3
PRACTICALS						
5.	PTEI7611	Industrial Automation Laboratory	0	0	4	2
		TOTAL	**12**	**0**	**4**	**14**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI7701	Instrumentation in Petrochemical Industry	3	0	0	3
2.		Elective VI	3	0	0	3
3.		Elective VII	3	0	0	3
PRACTICALS						
4.	PTEI7711	Project Work	0	0	9	6
		TOTAL	**9**	**0**	**9**	**15**

TOTAL NO. OF CREDITS: 100

ELECTIVES

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTGE7071	Disaster Management	3	0	0	3
2.	PTGE7072	Engineering Ethics and Human Values	3	0	0	3
3.	PTGE7073	Human Rights	3	0	0	3
4.	PTGE7074	Total Quality Management	3	0	0	3
5.	PTGE7075	Intellectual Property Rights	3	0	0	3
6.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
7.	PTEI7001	Advanced Control Engineering	3	0	0	3
8.	PTEI7002	Advanced Instrumentation Systems	3	0	0	3
9.	PTEI7003	Advanced Topics in PID Control	3	0	0	3
10.	PTEI7004	Applied Soft Computing	3	0	0	3
11.	PTEI7005	Bio Medical Instrumentation	3	0	0	3
12.	PTEI7006	Discrete Time Signal Processing	3	0	0	3
13.	PTEI7007	Fault Detection and Diagnosis	3	0	0	3
14.	PTEI7008	Fiber Optics and Laser Instrumentation	3	0	0	3
15.	PTEI7009	Fundamentals of Nano Science and MEMS	3	0	0	3
16.	PTEI7010	Fundamentals of Pneumatics and Hydraulics	3	0	0	3
17.	PTEI7011	Instrumentation Standards	3	0	0	3
18.	PTEI7012	Instrumentation System Design	3	0	0	3
19.	PTEI7013	Internet of Things	3	0	0	3
20.	PTEI7014	Microcontroller based System Design	3	0	0	3
21.	PTEI7015	Model Predictive Control	3	0	0	3
22.	PTEI7016	Non-Linear Control Systems	3	0	0	3
23.	PTEI7017	Nuclear Power Plant Instrumentation	3	0	0	3
24.	PTEI7018	Power Electronics Drives and Control	3	0	0	3
25.	PTEI7019	Robotics and Automation	3	0	0	3
26.	PTEI7020	Safety Instrumented System	3	0	0	3
27.	PTEI7021	Unit Operations and Control	3	0	0	3

PTMA7151 **APPLIED MATHEMATICS** **L T P C**

(Common to all branches of B.E / B.Tech (PT) Programmes) **3 0 0 3**

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES **9**

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION **9**

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **9**

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9**

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUT COMES :

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.

- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTPH7151 ENGINEERING PHYSICS L T P C

(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

OBJECTIVE:

- To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Poisson's ratio and relationship between moduli (qualitative) - stress-strain diagram for ductile and brittle materials, uses - factors affecting elastic modulus and tensile strength - bending of beams - cantilever - bending moment - Young's modulus determination - theory and experiment - uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - calculation of reverberation time for different types of buildings – sound absorbing materials - factors affecting acoustics of buildings : focussing, interference, echo, echelon effect, resonance - noise and their remedies. Ultrasonics: production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating – ultrasonic interferometer - industrial applications – Non-destructive testing - ultrasonic method: scan modes and practice.

UNIT III THERMAL AND MODERN PHYSICS 9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media - Forbe's and Lee's disc method: theory and experiment- Black body radiation – Planck's theory (derivation) – Compton effect – wave model of radiation and matter – Schrödinger's wave equation – time dependent and independent equations – Physical significance of wave function – particle in a one dimensional box.

UNIT IV APPLIED OPTICS 9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its applications - Lasers – principle and applications – Einstein's coefficients – CO_2 and Nd:YAG laser - semiconductor lasers: homo junction and hetro junction - construction and working – applications. Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

OUTCOME:

- The students will acquire knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXTBOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publications (2013)
2. Palanisamy P.K., "Engineering Physics", Scitech Publications (P) Ltd. (2006).
3. Arumugam M., "Engineering Physics", Anuradha Publications (2000)

REFERENCES:

1. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co. (2010).
2. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics". W.H.Freeman, (2007).
3. Markert J.T.,Ohanian, H. and Ohanian, M. "Physics for Engineers and Scientists". W.W.Norton & Co. (2007).

PTCY7151	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free

radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRYAND CATALYSIS 9

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions- Types of isotherms–Frendlich adsorption isotherm,Langmuir adsorption isotherm.Industrial applications of adsorption. Catalysis: Characteristics and types of catalysts-homogeneous and heterogeneous, auto catalysis. Enzyme catalysis -factors affecting enzyme catalysis, Michaelis-Menton equation.Industrial applications of catalysts.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry-Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes-internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines.Spectrophotometric estimation of iron.UV-Vis and IR spectroscopy-principles, instrumentation (Block diagram) and applications.

UNIT IV CHEMICAL THERMODYNAMICS 9

Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANOCHEMISTRY 9

Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties.Preparation of nanoparticles – sol-gel and solvothermal.Preparation of carbon nanotube by chemical vapour deposition and laser ablation.Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning.Properties and uses of nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

TOTAL : 45 PERIODS

COURSE OUTCOMES

- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXT BOOKS

1. Jain P. C. & Monica Jain., “Engineering Chemistry”, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2014.

2. Kannan P., Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014

REFERENCES

1. Pahari A., Chauhan B., “Engineering Chemistry”, Firewall Media, New Delhi, 2012.

2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.

3. AshimaSrivastava. Janhavi N N, Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi., 2010.

4. Vairam S., Kalyani P., Suba Ramesh., “Engineering Chemistry”, Wiley India Pvt Ltd., New Delhi., 2011.

PTGE7151	COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

Common to all branches of Engineering and Technology

OBJECTIVES:

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations.

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures – Unions

TOTAL : 45 PERIODS

At the end of the course, the student should be able to:

- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort**.**
- Use programming language to solve problems.

TEXT BOOKS

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013

2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.

3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

REFERENCES

1.Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006

2. Byron S Gottfried, "Programming with C", Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.

3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

PTEI7101	ELECTRONICS FOR ANALOG SIGNAL PROCESSING I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the students to the construction, operation, characteristics and applications of various semiconductor diodes and transistors.
- To impart knowledge on different types of configurations and biasing circuits for BJT and FET.
- To impart knowledge on single & multi-stage amplifiers, power amplifiers and oscillators.
- To enable the students to analyze a given BJT / FET amplifier circuit for voltage gain, current gain, input impedance, output impedance and bandwidth.
- To enable the students to design transistor amplifiers and oscillators for a given set of specifications.

UNIT I SEMICONDUCTOR DIODES 9

PN junction diode: Forward and reverse characteristics, Applications in Rectifier, Switching, Clipper, Clamper and Protection circuits - Zener diode: Forward and reverse characteristics, Application as voltage regulator, Introduction to special diodes: Schottky diode, Varactor diode, Laser diode, Photodiode – UJT characteristics and application as relaxation oscillator, Thyristors: Characteristics and applications of SCR, DIAC and TRIAC.

UNIT II BJT AMPLIFIERS 9

BJT: NPN and PNP transistors, Characteristics of CE, CB and CC amplifier configurations, Biasing circuits, Operating point, Load line – Hybrid model, Two-port analysis, Mid-band analysis of BJT

amplifier using h-parameters – High frequency model, Frequency response of BJT amplifier – Transistor switching circuits.

UNIT III FET AMPLIFIERS 9

FET: JFET and MOSFET, Characteristics of CS, CG and CD amplifier configurations – Biasing circuits for JFET and MOSFET, Operating point, Load line – Small signal model, Mid-band analysis of FET amplifier – High frequency model of FET, Frequency response of FET amplifiers - NMOS and CMOS inverter circuits.

UNIT IV MULTISTAGE AND FEEDBACK AMPLIFIERS 9

Multistage amplifier: Coupling schemes for cascading amplifier, General analysis of cascaded amplifier, Cascade and Bootstrap amplifiers. Feedback amplifier: Characteristics of feedback amplifier, AC analysis of feedback amplifiers: Voltage-Series, Voltage-Shunt, Current-Series and Current-Shunt amplifiers. Single and Double Tuned Amplifiers.

UNIT V OSCILLATORS AND POWER AMPLIFIERS 9

Oscillators: Classification, Condition for oscillation - Phase shift oscillators: RC phase shift and Wien Bridge oscillators - Resonant frequency oscillators: Hartley, Colpitts and crystal oscillators. Power amplifiers: Class A, Class B and Class AB amplifiers, Efficiency - Distortion in power amplifiers.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Apply the knowledge of semiconductor device fundamentals to understand the operation of any diode or transistor based circuit.
2. Analyze a given transistor amplifier end evaluate its performance with respect to gain, impedance and bandwidth.
3. Design single stage / multistage BJT/FET amplifiers for a given set of specifications. Select an appropriate diode / transistor circuit for a specific application.

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias, Satyabrata Jit, “Electronic Devices and Circuits”, 3rd Edition, McGraw-Hill, 2011.

2. Donald A. Neaman, “Electronic Circuits Analysis and Design”, 3rd Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. David A. Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2008.

2. Sedra and Smith, “Microelectronic circuits”, 7th Edition, Oxford University Press, 2014.

3. Ben G. Streetman and Sanjay K. Banerjee, “Solid State Electronic Devices”, 7th Edition, 2014.

4. Donald A. Neaman, “Semiconductor Physics and Devices Basic Principles”, 3rd Edition, McGraw-Hill, 2003.

5. Salivahanan, S. and Suresh Kumar, N., “Electronic Devices and Circuits”, 2nd edition, McGraw-Hill, 2011.

6. NPTEL video lectures on "Electronics for Analog Signal Processing I" by Prof. K.R.K. Rao, IITM.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	C	d	e	f	g	h	i	j	k	l
1	✓											
2		✓										
3			✓									
4					✓							

PTEI7201 ELECTRICAL AND ELECTRONIC MEASUREMENTS LT PC
3 0 0 3

COURSE OBJECTIVES

- To provide knowledge in the specific area of electrical measuring instruments. Emphasis is laid on the meters used to measure current, voltage, resistance, inductance and capacitance.
- To have an adequate knowledge in the measurement techniques for power and energy.
- Elaborate discussion about potentiometer and to impart knowledge on various instrument transformers and to understand the calibration of various meters.
- In-depth understanding and idea of analog and digital instruments.
- Detailed study of display and recording devices.

UNIT I MEASUREMENT OF ELECTRICAL PARAMETERS 9

Types of ammeters and voltmeters: PMMC Instruments, Moving Iron Instruments, Dynamometer type Instruments – Resistance measurement: Wheatstone bridge, Kelvin double bridge and Direct deflection methods. Measurement of Inductance: Maxwell-Wein Bridge, Hay's bridge and Anderson Bridge - Measurement of Capacitance: Schering Bridge.

UNIT II POWER AND ENERGY MEASUREMENTS 9

Electro-dynamic type wattmeter: Theory and its errors – LPF wattmeter – Phantom loading – Single phase Induction type energy meter: Theory and Adjustments – 3 phase induction energy meter and phase measurement– Calibration of wattmeter and Energy meters – Synchroscope.

UNIT III POTENTIOMETERS AND INSTRUMENT TRANSFORMERS 9

D.C. Potentiometers: Student type potentiometer, Precision potentiometer – A.C. Potentiometers: Polar and Coordinate types – Applications – Instrument Transformer: Construction and theory of Current Transformers and Potential Transformers.

UNIT IV ANALOG AND DIGITAL INSTRUMENTS 9

Wave analyzers – Signal and function generators – Distortion factor meter – Q meter – Digital voltmeter and multi-meter – Microprocessor based DMM with auto ranging and self diagnostic features – Frequency measurement.

UNIT V DISPLAY AND RECORDING DEVICES 9

Cathode ray oscilloscope: Classification, Sampling and storage scopes – LED, LCD and dot matrix displays –Trends in display technologies – X-Y recorders – Magnetic tape recorders –Digital Data Recording –Digital memory waveform recorder – Data loggers.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. An ability to compare the working principles, merits, demerits and errors of different types of electrical instruments and can understand about different instruments that are used for measurement purpose.
2. Understanding of how different bridge networks are constructed and balanced for finding out values of resistance, capacitance and inductance.
3. An ability to apply knowledge of electronic instrumentation for measurement of electrical quantities.
4. Able to apply the principles and practices for instrument design and development to real world problems.

TEXT BOOKS:

1. Kalsi, H.S., " Electronic Instrumentation", Tata McGraw-Hill, New Delhi, 2010.

2. Sawhney, A.K., "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co., New Delhi, 2010.

REFERENCES:

1. Northrop, R.B., "Introduction to Instrumentation and Measurements", Taylor & Francis, New Delhi, 2008.

2. Carr, J.J., "Elements of Electronic Instrumentation and Measurement", Pearson Education India, New Delhi, 2011.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	E	f	g	h	i	j	k	l
1	✓											✓
2				✓								
3	✓											
4					✓							

PTEI7202 ELECTRONICS FOR ANALOG SIGNAL PROCESSING II LT P C
3 0 0 3

COURSE OBJECTIVES

- To introduce the basics of operational amplifiers, their characteristics and their configurations.
- To impart knowledge about the concepts and applications of timer, PLL, ADC and DAC.
- To enable the students to analyze the given integrated circuit and evaluate the output.
- To enable the students to design signal conditioning circuits using operational amplifiers.
- To enable the students to design multi-vibrator circuits using OPAMP / Timer for switching applications.

UNIT I OPERATIONAL AMPLIFIERS 9

Differential amplifier: BJT and FET configurations, Differential mode and common mode equivalent circuits, Single-ended and Double-ended output, CMRR – OPAMP: Internal blocks, Ideal characteristics, DC and AC characteristics of non-ideal OPAMP, Frequency compensation techniques, Methods of improving Slew rate and CMRR – Inverting and Non-inverting OPAMP configurations, Summing and Difference amplifiers.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIER 9

Differentiator and Integrator: ideal and practical circuits, V to I and I to V converters - Instrumentation amplifier circuit analysis, Instrumentation amplifier IC – Active Filters: Low pass, High pass, Band pass and Band reject filters – Comparator, Schmitt trigger, Multi-vibrators, Triangular wave generator, Sine wave generator, Function generator - Clipper and Clamper – Log and Antilog amplifiers.

UNIT III TIMER AND PHASE LOCKED LOOP 9

Timer IC: Internal blocks – Multi-vibrator circuits and their applications. VCO: Functional block diagram, Operation, V-F conversion factor, Application – Phase detector: Analog and Digital, Conversion gain – PLL IC: Internal block diagram, Operation, Capture range, Lock range, Applications: Generation of FM signal, Demodulation of AM, FM and FSK signals.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Analog switches, Sample and hold IC, DAC principle, Resolution, Range – Types: Weighted R, R-2R and Inverted R-2R, DAC ICs – ADC: Principle, Types: Flash, Counting, Single slope, Dual slope, Successive approximation – ADC ICs.

UNIT V SPECIAL FUNCTION IC'S 9

Analog multiplier: Single, double and four quadrant multipliers - Operational trans-conductance amplifier, Power amplifier: Audio and video amplifiers – Linear voltage regulator: Internal blocks, low and high voltage regulator operation, Current protection – Switched regulator, Buck, Boost & Buck/boost regulators – Switched capacitor filter, Isolation amplifier, Opto-coupler.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to interpret data sheet of a given analog IC.
2. Ability to apply the knowledge of analog IC's to understand the operation of a given

electronic circuit involving IC's.

3. Ability to analyze an electronic circuit involving IC's and evaluate its output.
4. Ability to design an analog IC based electronic circuit for a given application.
5. Compare the performance of IC based circuits with discrete component circuits for the same application.

TEXT BOOKS:

1. Ramakant Gayakwad, "Op-amps and Linear Integrated Circuits", 4th Edition, Prentice Hall, 2000.

2. Robert, F., Coughlin, Frederick F., Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 5th Edition, Prentice Hall, 1998.

REFERENCES:

1. Sergio Franco, "Design with Operational Amplifiers and Linear Integrated Circuits", 3rd Edition, Tata McGraw-Hill, 2002.

2. Paul R. Gray, "Analysis and Design of Analog Integrated Circuits", 5th Edition, Wiley, 2010.

3. Roy Choudhry, D. and Shail B. Jain, "Linear Integrated Circuits", 2nd Edition, New Age International, 2003.

4. NPTEL video lectures on "Electronics for Analog Signal Processing II" by Prof. K.R.K. Rao, IITM.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	B	c	d	e	f	g	h	i	j	k	l
1				✓								
2	✓											
3		✓										
4				✓								
5					✓							

PTEI7203 INSTRUMENT TRANSDUCERS LT P C
3 0 0 3

COURSE OBJECTIVES

- Get to know the methods of measurement, classification of transducers and to analyze error.
- To understand the behavior of transducers under static and dynamic conditions and hence to model the transducer.
- Get exposed to different types of resistive transducers and their application areas.
- To acquire knowledge on capacitive and inductive transducers.
- To gain knowledge on variety of transducers and get introduced to MEMS and Smart transducers.

UNIT I SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS 9

Units and standards – Static calibration – Classification of errors, Limiting error and probable error – Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

UNIT II CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics: Accuracy, precision, resolution, sensitivity, linearity, span and range. Dynamic characteristics: Mathematical model of transducer, Zero, I and II order transducers, Response to impulse, step, ramp and sinusoidal inputs.

UNIT III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezo-resistive sensor and humidity sensor.

UNIT IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 9

Inductive transducers – Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer – Variable reluctance transducers – Synchros – Microsyn – Principle of operation, construction details, characteristics of Capacitive transducers – Different types & Signal Conditioning – Applications: Capacitor microphone, Capacitive pressure sensor, Proximity sensor.

UNIT V OTHER TRANSDUCERS 9

Piezoelectric transducer – Hall Effect transducer – Magneto elastic sensor – Digital transducers – Fiber optic sensors – Thick & Thin Film sensors (Bio sensor & Chemical Sensor) – Environmental Monitoring sensors (Water Quality & Air pollution) – Introduction to MEMS – Introduction to Smart transducers and its interface standard (IEEE 1451).

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to apply the mathematical knowledge and science & engineering fundamentals

gained to solve problems pertaining to measurement applications.
2. Be able to analyze the problems related to sensors & transducers.
3. Be able to select the right sensor/transducer for a given application.
4. Be able to determine the static and dynamic characteristics of transducers using software packages.

TEXT BOOKS:

1. Doebelin E.O. and Manik D.N., "Measurement Systems", 6th Edition, Tata McGraw-Hill Education Pvt. Ltd., 2011.

2. Renganathan, S.," Transducer Engineering", Allied Publishers, New Delhi, 2003.

REFERENCES:

1. Neubert, H.K.P., "Instrument Transducers – An Introduction to their Performance and Design", Oxford University Press, Cambridge, 2003.

2. Albert, D. Helfrick and Cooper, W. D., "Modern Electronic Instrumentation and Measurement Techniques", PHI Learning Pvt. Ltd., 2011.

3. Murthy, D.V.S., "Transducers and Instrumentation", 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.

4. John P. Bentley, "Principles of Measurement Systems", 4th Edition, Pearson Education, 2004.

5. Bolton, W., "Engineering Science", Elsevier Newnes, 5th Edition, 2006.

6. Patranabis, D., "Sensors and Transducers", 2nd Edition, Prentice Hall of India, 2010.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	L
1	✓	✓										
2					✓							
3				✓	✓							
4					✓							

PTEI7204	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the representation and classification of continuous-time and discrete-time signals.
- To impart knowledge on the methods and impact of analog to digital conversion and digital to analog conversion.
- To teach the analysis of CT and DT systems through various transform techniques such as Laplace transform, Fourier transform and Z-transform.
- To familiarize the concept of random signals and their statistical properties.

UNIT I INTRODUCTION TO CT SIGNALS AND SYSTEMS 9

Introduction to signals and systems and their classifications. Definition of CT signal, Representation of elementary CT signals: – Impulse, Pulse, Step, Ramp, Exponential, Sinusoidal. Classification of CT signals: – periodic and a-periodic, power and energy, deterministic and random signals. Definition of CT system, Classification and characterization with examples: – Static & dynamic, causal & non causal, linear & non linear, time variant & time invariant, stable & unstable, FIR & IIR.

UNIT II ANALYSIS OF CT SIGNALS AND SYSTEMS 9

Time domain analysis:-solutions of differential equation. Fourier series and Fourier transform analysis of signals, spectrum of CT signals, Laplace Transform analysis of signals and systems, Analysis of random signals.

UNIT III DISCRETIZATION AND SIGNAL RECONSTRUCTION 9

Discretization of signals: sample and hold circuit**, Sampling:-** Sampling theorem, selection of sampling rate, Types of sampling, Aliasing:- Aliasing effects, Anti-aliasing filter, Quantization:- Quantization errors due to truncation and rounding in fixed and floating point representations, signal reconstruction:-Interpolation using zero-order hold & first order hold.

UNIT IV CLASSIFICATION AND ANALYSIS OF DISCRETE TIME SIGNALS 9

DT signals: – Introduction, Definition, Elementary DT signals, Characterization. DT systems: Definition, Classification, Characterization. Time domain analysis: - Solutions of difference equations.

UNIT V TRANSFORM TECHNIQUES FOR DT SIGNALS AND SYSTEMS 9

Discrete Time Fourier Transform:– Definition, Existence and Properties. Z-Transform – Definition, Properties, ROC and its properties, Inverse Z Transform. Analysis of DT systems using Z Transforms: – Stability, Causality, Recursive, Non-recursive systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students

- Will gain ability to generate different types of CT and DT signals.
- Will be capable to analyze and characterize any given CT or DT system and obtain the time response and frequency response.
- Will gain knowledge on the application of transform techniques.
- Will be familiarized with random signals and their statistical properties.

TEXT BOOKS

1. Allan V. Oppenheim, S. Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, Indian Reprint, 2007.

2. Tarun Kumar Rawat, Signals and Systems,Oxford University Press,2010

3. Arun K Tangirala, Principles of system identification, CRC press 2015

REFERENCES

1. H P Hsu, Signals and Systems, Schaum's Outlines,Tata McGraw Hill,2006.

2. John Alan Stuller, An Introduction to signals and Systems,Thomson,2007.

3. Edward W Kamen,Bonnie S Heck,Fundamentals of Signals and Systems using the Web and MATLAB,Pearson,Indian Reprint,2007.

PTEI7211 SENSORS AND SIGNAL CONDITIONING LABORATORY LT P C
0 0 4 2

COURSE OBJECTIVES

- To make the students aware of basic concepts of measurement and operation of different types of transducers.
- To make the students conscious about static and dynamic characteristics of different types of transducer.

LIST OF EXPERIMENTS

1. Static and Dynamic characteristics of Thermocouple (J,K,E) with and without thermo-well.
2. Static and Dynamic characteristics of RTD and Thermistor.
3. Characteristics of linear displacement transducers (LVDT and Hall Effect sensor).

4. Characteristics of angular displacement transducers (Synchros and Capacitive transducer).

5. Sensitivity analysis of strain gauge bridges (quarter, half and full).

6. a. Static characteristic of flapper-nozzle system.

   b. Loading effect on resistive potentiometer.

7. Characteristic of seismic type accelerometer.

8. Measurement of inductance (Anderson), capacitance (Schering) and resistance (Kelvin double) using bridges.

9. a. Design of V/I and I/V converters.

   b. Design and testing of Instrumentation amplifier.

10. Design of cold junction compensation for Thermocouples and lead wire compensations for RTD.

11. Design of signal conditioning circuits for high output impendence sensor (pH).

12. PC Based Data Acquisition system.

TOTAL : 60 PERIODS

COURSE OUTCOMES(COs)

1. Understand the concepts of measurement, error and uncertainty.
2. Understand the static and dynamic characteristics of measuring instruments.
3. Gain knowledge about the principle of operation and characteristics of different types of resistance, capacitance and inductance transducers.
4. Acquire knowledge of operation and applications of special transducers.
5. Acquire knowledge of interfacing and analyzing different stages of signal conditioning units.
6. Ability to present the results in oral form as well as in written form as a report.
7. Ability to interpret the results and draw meaningful conclusions.
8. Ability to work as a member of a team while carrying out experiments.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO\PO	a	B	c	d	e	f	g	h	i	j	k	l
1	✓	✓	✓									
2	✓	✓	✓	✓								
3				✓	✓							
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5				✓	✓	✓	✓					
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7				✓								
8									✓		✓	

PTEI7301 **CONTROL SYSTEMS** **LT P C**
3 0 0 3

COURSE OBJECTIVES

- To make the students familiarize about various representations of systems.
- To develop linear models mainly state variable model and Transfer function model from Non Linear systems.
- To make the students analyze linear systems in time domain and frequency domain.
- To train the students to design compensator for system(s) using time and frequency domain techniques.

UNIT I MODELING OF LINEAR TIME INVARIANT SYSTEM (LTIV) 9

Control system: Open loop and Closed loop – Feedback control system characteristics – First principle modeling: Mechanical, Electrical and Hydraulic systems – Transfer function representations: Block diagram and Signal flow graph.

UNIT II STATE SPACE MODEL OF LTIV AND LTV SYSTEMS 9

State variable formulation – Non uniqueness of state space model – State transition matrix –Free and forced responses for Time Invariant and Time Varying Systems – Controllability – Observability.

UNIT III TIME DOMAIN AND STABILITY ANALYSIS 9

Standard test inputs – Time responses – Time domain specifications – Stability analysis: Concept of stability – Routh Hurwitz stability criterion – Root locus: Construction and Interpretation.

UNIT IV FREQUENCY DOMAIN ANALYSIS 9

Frequency response plots: Bode plot, Polar plot and Nyquist plot – Frequency domain specifications: Resonance peak, Resonant frequency and Bandwidth – Stability Analysis: Gain margin and Phase margin.

UNIT V DESIGN OF FEED BACK CONTROL SYSTEM 9

Design specifications – Lead, Lag and Lag-lead compensators using Root locus and Bode plot techniques – Introduction to Non-linear system.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to develop various representations of system based on the knowledge of Mathematics, Science and Engineering fundamentals.
2. Ability to do time domain and frequency domain analysis of various models of linear system.
3. Ability to come out with solution for complex control problem.
4. Ability to interpret characteristics of the system to develop mathematical model.
5. Ability to design appropriate controller for the given specifications.

TEXT BOOKS:

1. Benjamin C. Kuo, “Automatic Control Systems”, 7th Edition PHI Learning Private Ltd., 2010.

2. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2010.

REFERENCES:

1. Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Education Pearson, 3rd Impression, 2009.

2. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.

3. Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private Ltd, 5th Edition, 2010.

4. NPTEL Video Lecture Notes on "Control Engineering "by Prof. S. D. Agashe, IIT Bombay.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	J	k	l
1	✓											
2		✓										
3			✓									
4				✓								
5			✓									

PTEI7302 DIGITAL PRINCIPLES AND APPLICATIONS LT P C
3 0 0 3

COURSE OBJECTIVES

- To study various number systems, Boolean expressions and simplifications.
- To study, analyze and design of the combinational logic circuits for arithmetic operations.
- To study, analyze and design of sequential circuits, registers and counters.
- To study, analyze and design asynchronous sequential circuits and to know the functions of ASM charts.
- To learn memory components, PLA, PAL and the basic of HDL.

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Review of number systems – Arithmetic operations in binary number system – Binary codes – Boolean algebra and rules – Boolean functions: Simplifications: standard / canonical form of SOP and POS, Simplification using Karnaugh Map and Tabulation methods – Basic logic gates – Universal gates.

UNIT II COMBINATIONAL LOGIC 9

Combinational circuits – Analysis and design procedures – Circuits for arithmetic operations: Full adder, Carry look-ahead adder, binary adder, adder-subtractor, comparators – Code conversion – Decoders and Encoders – Multiplexers and De-multiplexers.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 9

Sequential circuits – Flip flops: Triggering, types, conversions, excitation tables – Analysis and design procedures – State reduction and state assignment – Shift registers – Counters: MOD counters, up-down counter, ring counters – Sequence detectors.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 9

Analysis and design of asynchronous sequential circuits – Reduction of state and flow tables – Race-free state assignment – Arithmetic State Machines: Introduction, components, features, examples.

UNIT V MEMORY AND PROGRAMMABLE LOGIC DEVICES 9

RAM and ROM types – Memory decoding - Error detection and correction - Programmable logic devices: Programmable Array Logic – Programmable Logic Array – Types of sequential programmable devices – Hardware Description Language: Introduction - HDL for combinational logic circuits - HDL for Sequential logic circuits.

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

At the end of the course, the student should have the ability:

1. To apply mathematics knowledge of number systems, Boolean expressions / functions.
2. To analyze the combinational and sequential circuits.
3. To design combinational logic circuits for different problems.
4. To design sequential logic circuits for various problems.
5. To investigate various programmable logic devices.

TEXT BOOKS:

1. Morris Mano, M. and Michael D. Ciletti, “Digital Design with an Introduction to the Verilog HDL”, 5th Edition, Prentice Hall, 2013.

2. Donald P Leach, Albert Paul Malvino and Goutam Saha, “Digital Principles and Applications”, 8th Edition, McGraw-Hill, 2014.

REFERENCES:

1. Thomas L. Floyd, “Digital Fundamentals”, 11th Edition, Prentice Hall, 2015.

2. Anand Kumar, A., “Switching Theory and Logic Design”, 2nd Edition, PHI, 2014.

3. John F. Wakerly, “Digital Design Principles and Practices”, Pearson Education, 2008.

4. Arijith Saha and Nilotpal Manna, “Digital Principles and Logic Design”, Laxmi Publication, 2008.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO \ PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓	✓										
2		✓										
3		✓	✓	✓								
4		✓	✓	✓								
5				✓								

PTEI7303 INDUSTRIAL INSTRUMENTATION I LT P C
3 0 0 3

COURSE OBJECTIVES

- To make students understand the various measuring techniques for displacement, velocity, force, torque, acceleration, vibration, density, viscosity, humidity and moisture

UNIT I MEASUREMENT OF DISPLACEMENT AND VELOCITY 9

Displacement: Gauge blocks, Ultrasonic, Laser Interferometer Displacement Sensors - Michelson, Magnetic Displacement Sensors: Magnetostrictive Sensors, Magnetoresistive Sensors, Hall Effect Sensors and Magnetic Encoders, optical encoders and syncro resolver. Velocity: Relative, translational and rotational velocity measurement - revolution counter and timer – capacitive acho - drag cup type tacho - AC and DC tacho generators- Stroboscope.

UNIT II MEASUREMENT OF FORCE AND TORQUE 9

Force: Analytical balance, Steel yard, Electronic microbalance- Hydraulic, Pneumatic, Strain gauge, Magneto-elastic and Piezoelectric load cells Torque: Measurement using load cell, Strain gauge and relative angular twist

UNIT III MEASUREMENT OF ACCELERATION, VIBRATION AND SHAFT POWER 9

Measurement of Acceleration: LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers - Gyroscopes. Measurement of vibration: Mechanical type vibration instrument, calibration of vibration pickup .Shaft power measurement: Torsion dynamometer - prony brake - hydraulic absorption dynamometer.

UNIT IV MEASUREMENT OF VISCOSITY AND DENSITY 9

Viscosity: Units and definitions of viscosity terms - Friction tube Viscometer, Saybolt viscometer, Rotameter type and Torque type viscometers - Industrial Consistency Meters

Density: Baume scale and API scale, Pressure head type densitometers, displacer type densitometer, Float type densitometers, buoyancy effect densitometer, radioactive and resonance type densitometer, Ultrasonic densitometer and hot wire gas bridge densitometer.

UNIT V MEASUREMENT OF HUMIDITY AND MOISTURE 9

Humidity: Definitions of humidity terms - Dry and wet bulb psychrometers – hair hygrometer - Resistive and capacitive type hygrometers – Dew cell –Commercial type dew meter.

Moisture: Different terms to express moisture content in a material - Different methods of moisture measurements: Thermal, Conductivity and Capacitive sensors, Microwave, IR and NMR sensors, Application of moisture measurement - Moisture measurement in granular materials, solid penetrable materials like wood.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

- Ability to understand the construction and working of instruments used for measurement of Displacement, velocity, force, torque, acceleration, vibration, shaft power, density, viscosity, humidity and moisture.
- Ability to select instruments according to the application.
- Understand the concept of calibration of measuring instruments

TEXT BOOKS:

1. Doebellin, E.O. and Manik D.N., “Measurement systems Application and Design”, 5th Edition, Tata McGraw-Hill Education Pvt. Ltd, 2007.

2. Jones, B.E., “Instrument Technology”, Vol.2, Butterworth-Heinemann, International Edition, 2003.

REFERENCES:

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 2005.

2. Patranabis, D., “Principles of Industrial Instrumentation”, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2010.

3. Eckman D.P., “Industrial Instrumentation”, Wiley Eastern Limited, 1990.

4. Singh,S.K., “Industrial Instrumentation and Control”, Tata Mc-Graw-Hill Education Pvt. Ltd., New Delhi, 2009.

5. Alok Barua, “Lecture Notes on Industrial Instrumentation”, NPTEL, E-Learning Course, IIT Kharagpur.

6. Jayashankar, V., “Lecture Notes on Industrial Instrumentation”, NPTEL, E-Learning Course, IIT Madras.

PTEI7304	MICROPROCESSORS, MICROCONTROLLERS AND APPLICATIONS	L T P C 3 0 0 3

COURSE OBJECTIVES

- To get familiarized with architecture, addressing modes and instructions of 8085 & 8086 microprocessor.
- To get exposed to high Performance and advanced architectures.
- To gain knowledge on essential peripherals and the associated interfacing ICs.
- To get acquainted with 8-bit microcontroller and be able to program in assembly and C-language.
- To design microcontroller based system/application.

UNIT I ARCHITECTURE OF 8085/8086 PROCESSOR 9

Evolution of Microprocessors – Introduction to 8085 – Architecture – Addressing Modes –Timing diagrams – Introduction to 8086 – Architecture – Maximum mode – Minimum mode – Addressing Modes & Programming.

UNIT II ADVANCED ARCHITECTURES 9

Road to Higher Performance – Past and current Performance, Trends in Processor – Pipeline concepts and Performance – Superscalar Processing – Hardware Accelerators – Multiprocessor – RISC and CISC Processors – Nano Programming – Case study

UNIT III PERIPHERALS AND THEIR INTERFACING 9

Programmable Peripheral Interface (8255) - Keyboard display controller (8279) – ADC – DAC Interface – Programmable Timer Controller (8254) – Programmable interrupt controller (8259) – Serial Communication Interface (8251) – DMA Controller (8257).

UNIT IV MICROCONTROLLER ARCHITECTURE & PROGRAMMING 9

8051 Microcontroller – Architecture – Instruction Set – Addressing modes – Interrupts – Assembly Language Programming - Programming 8051 Timers – Serial Port Programming – Interrupts Programming – 8051 Programming in C.

UNIT V 8051: INTERFACING AND SYSTEM DESIGN 9

LCD & Keyboard Interfacing – ADC, DAC interfacing – External Memory interfacing – Sensor Interfacing – Motor Control – Relay – PWM – DC & Stepper Motor – Design of traffic light control and Washing machine control.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to understand the architecture of any advanced Processor to keep in pace with technological challenges.
2. Apply the acquired Programming skills and relate to any Processor/microcontroller in a multidisciplinary project.
3. Able to utilize the IT tools like TASM, MASM and Proteus to develop electronic prototyping and thereby establishing real time control.

4. Ability to develop/design microcontroller based system paving way for automation and continuous development.

TEXT BOOKS:

1. Ramesh S. Gaonkar, "Microprocessor Architecture Programming and Applications with 8085", 6th edition, Penram International Publishing, 2013.

2. Douglas V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Revised 2nd Edition, Indian edition 2007, 11th Reprint 2010, Tata McGraw-Hill.

REFERENCES:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D.MCKinlay, "The 8051 Microcontroller and Embedded Systems", 2nd Edition 2008, 5th Reprint, 2010, Pearson Education.

2. Krishna Kant, "Microprocessor and Microcontroller Architecture programming and system design using 8085, 8086, 8051, 8096, PHI", 7th Reprint 2011.

3. Ray, A.K. and Bhurchandi, K.M., "Advanced Microprocessor and Peripherals", 2nd Edition, Tata McGraw-Hill, 2007.

4. Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thompson Delmar Learning, 2007, New Delhi.

5. Dogan Ibrahim, "Microcontroller Based Applied Digital Control", John Wiley & Sons Ltd, 2006.

6. John P.Hayes, "Computer Architecture & Organization", 3rd Edition, Tata McGraw-Hill, 1998.

7. Behrooz Parhami, "Computer Architecture From Microprocessor to supercomputer", Oxford Publishing, 2014 Indian Reprint.

8. Krishna Kumar, "Lecture Notes on Microprocessors and Microcontrollers", NPTEL, E-Learning Course, IISc Bangalore.

9. Pramod Agarwal, "Lecture Notes on Microprocessor", NPTEL, E-Learning Course, IIT Roorkee.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/ PO	a	b	c	d	e	f	g	h	i	j	k	l
1												✓
2									✓			
3					✓							
4							✓					

PTEI7311 MICROPROCESSOR AND INTERFACING LABORATORY LT P C
0 0 4 2

COURSE OBJECTIVES

- To develop skill in program writing for 8085, 8086 processors and 8051microcontroller.
- To gain Practical knowledge on interfacing hardware and associated software.
- To get trained to Programming and interfacing using simulators.
- To get exposed to programming and interfacing using ARM7, ARM11, MSP430, and PIC microcontroller.

LIST OF EXPERIMENTS

ASSEMBLY LANGUAGE PROGRAMMING

1. a) Understanding the instruction set of 8085 µp.

   b) PROGRAMMING using Arithmetic, Logical instructions of 8085 microprocessor.

2. a) Understanding the instruction set of 8086 µp.

   b) Programming using String manipulation instructions (Compare &Scan) of 8086 microprocessor.

3. a) Understanding the instruction set of 8051 µc.

   b) Programming using Arithmetic, Logical and Bit manipulation instructions of 8051 microcontroller

SIMULATION EXPERIMENTS

4. Turbo assembler Programming (using arithmetic, logical, string instructions) of 8086.
5. Interfacing Keyboard / LCD with µc.
6. Interfacing ADC/DAC/ stepper motor with µc.

Hardware based Experiments using 8085 / 8086 / 8051 / ARM7 / ARM11 / MSP430 and PIC MICROCONTROLLER

7. Interfacing ADC and DAC with µp / µc.
8. Data transfer between computer and µp / µc.
9. a) Interfacing Keypad (4 x 4) with µp / µc.

   b) Interfacing LCD with µp / µc .

. 10. **I^2C** based RTC/ EEPROM/ 7-Segment display Interface with µp / µc.

11. Interfacing limit Switches/ Push buttons/ Solenoid valves/ Pumps with µp / µc.

12. a) Realization of PID algorithm in µp / µc.

b) µp / µc based control of temperature / Level process.

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)

1. Ability to exploit the features/instruction of the microprocessor and microcontroller to develop microprocessor/microcontroller based system.
2. Provide automation solutions to the real-time processes and thereby improving the efficiency.
3. Facilitate interdisciplinary projects based on the acquired programming skills.
4. Ability to present the results in oral form as well as in written form as a report
5. Ability to interpret the results and draw meaningful conclusions.
6. Ability to work as a member of a team while carrying out experiments.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1		✓										
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3									✓			
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5				✓						✓		
6									✓			

PTEI7401 **ANALYTICAL INSTRUMENTS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the theory and operational principles of instrumental methods for identification and quantitative analysis of chemical substances by different types of spectroscopy.
- To impart fundamental knowledge on gas chromatography and liquid chromatography.
- To integrate a fundamental understanding of the underlining principles of physics as they relate to specific instrumentation used for gas analyzers and pollution monitoring instruments.
- To impart knowledge on the important measurement in many chemical processes and laboratories handling liquids or solutions.
- To understand the working principle, types and applications of NMR and Mass spectroscopy.

UNIT I SPECTROPHOTOMETRY 9

Spectral methods of analysis – Beer-Lambert law – UV-Visible spectroscopy – IR Spectrophotometry - FTIR spectrophotometry – Atomic absorption spectrophotometry - Flame emission and atomic emission photometry – Construction, working principle, sources detectors and applications.

UNIT II CHROMATOGRAPHY 9

General principles – classification – chromatographic behavior of solutes – quantitative determination – Gas chromatography – Liquid chromatography – High-pressure liquid chromatography – Applications.

UNIT III INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS 9

Gas analyzers – Oxygen, NO_2 and H_2S types, IR analyzers, thermal conductivity detectors, analysis based on ionization of gases.

Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

UNIT IV pH METERS AND DISSOLVED COMPONENT ANALYZERS 9

Selective ion electrodes - Principle of pH and conductivity measurements - dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer – Water quality Analyzer.

UNIT V NUCLEAR MAGNETIC RESONANCE AND MASS SPECTROMETRY 9

NMR – Basic principles – Continuous and Pulsed Fourier Transform NMR spectrometer – Mass Spectrometry – Sample system – Ionization methods – Mass analyzers – Types of mass spectrometry.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Understand the fundamental principles of selective analytical instruments used in medical diagnosis, quality assurance & control and research studies.
2. Assess and suggest a suitable analytical method for a specific purpose, and evaluate sensitivity, important sources of interferences and errors, and also suggest alternative

analytical methods for quality assurance.
3. Critically evaluate the strengths and limitations of the various instrumental methods.
4. Develop critical thinking for interpreting analytical data.

TEXT BOOKS:

1. Braun, R.D., "Introduction to Instrumental Analysis", Pharma Book Syndicate, Singapore, 2006.

2. Willard, H.H., Merritt, L.L., Dean, J.A., Settle, F.A., "Instrumental methods of analysis", CBS publishing & distribution, 7th Edition, 2012.

3. Robert E. Sherman., "Analytical Instrumentation", Instruments Society of America, 1996.

REFERENCES:

1. Khandpur, R.S., "Handbook of Analytical Instruments", Tata McGraw-Hill publishing Co. Ltd., 2nd Edition 2007.

2. Ewing, G.W., "Instrumental Methods of Chemical Analysis", McGraw-Hill, 5th Edition reprint 1985. (Digitized in 2007).

3. Liptak, B.G., "Process Measurement and Analysis", CRC Press, 5th Edition, 2015.

4. NPTEL lecture notes on, "Modern Instrumental methods of Analysis" by Dr.J.R. Mudakavi, IISC, Bangalore.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	F	g	h	i	j	k	l
1	✓											
2					✓							
3			✓									
4				✓								

PTEI7402 INDUSTRIAL INSTRUMENTATION II LT P C
3 0 0 3

COURSE OBJECTIVES

- To make students understand the various measuring techniques for temperature and pressure.
- To make students analyze the characteristics of each measurement device and design signal conditioning circuits for the same.

UNIT I PRESSURE MEASUREMENT I **9**

Units of pressure – Different types of Manometers- Elastic type pressure gauges: Bourdon tube, Bellows, Diaphragms and Capsules - Electrical methods: Elastic elements with LVDT and strain

gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor

UNIT II PRESSURE MEASUREMENT II **8**

Measurement of vacuum: McLeod gauge, Thermal conductivity gauge, lionization gauges, Cold cathode type and hot cathode type – Installation and maintenance of pressure gauges - Calibration: Dead Weight Tester.

UNIT III TEMPERATURE MEASUREMENT I **10**

Definitions and standards – Primary and secondary fixed points – Thermometers: Different types of filled in system thermometers, sources of errors and their compensation – Bimetallic thermometers – Thermistors: Material, Construction, working, characteristics and linearization.

UNIT IV TEMPERATURE MEASUREMENT II **10**

RTDs: Material, Construction, Working, characteristics, lead wire compensation and signal conditioning circuit. IC sensor.

Thermocouples: Laws of thermocouple, Fabrication of industrial thermocouples, Reference junctions compensation, Commercial circuits for cold junction compensation, Response of thermocouple, Signal conditioning for thermocouple, Special techniques for measuring high temperature using thermocouple - installation and maintenance of thermocouples.

UNIT V TEMPERATURE MEASUREMENT III **8**

Radiation fundamentals - Radiation methods of temperature measurement – Optical pyrometers - Total radiation pyrometers —- Two color radiation pyrometers – Fiber optic sensor for temperature measurement – Thermograph, Temperature switches and thermostats.

TOTAL : 45 PERIODS

COURSE OUTCOMES

1. Ability to understand the construction and working of instruments used for measurement of temperature and pressure.
2. Ability to select instruments according to the application.
3. Understand the concept of calibration of instruments and gain knowledge about temperature measurement devices.
4. Ability to design signal conditioning circuits and compensation schemes for temperature measuring instruments.

TEXT BOOKS:

1. Doebellin, E.O. and Manik D.N., “Measurement systems Application and Design”, 5th Edition, Tata McGraw-Hill Education Pvt. Ltd, 2007.

2. Jones, B.E., “Instrument Technology”, Vol.2, Butterworth-Heinemann, International Edition, 2003.

REFERENCES:

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 2005.

2. Patranabis, D., “Principles of Industrial Instrumentation”, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2010.

3. Eckman D.P., “Industrial Instrumentation”, Wiley Eastern Limited, 1990.

4. Singh,S.K., “Industrial Instrumentation and Control”, Tata Mc-Graw-Hill Education Pvt. Ltd., New Delhi, 2009.

5. Alok Barua, “Lecture Notes on Industrial Instrumentation”, NPTEL, E-Learning Course, IIT Kharagpur.

6. Jayashankar, V., “Lecture Notes on Industrial Instrumentation”, NPTEL, E-Learning Course, IIT Madras. Temperature sensor selection, Installation and Calibration. selection and installation .

PTEI7403 **PROCESS CONTROL** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce technical terms and nomenclature associated with Process control domain.
- To familiarize the students with characteristics, selection, sizing of control valves.
- To introduce students to the fundamentals of system identification.
- To provide an overview of the features associated with Industrial type PID controller.
- To make the students understand the various PID tuning methods.
- To elaborate different types of control schemes such as cascade control, feed-forward control and Model Based control schemes.

UNIT I PROCESS DYNAMICS **9**

Need for process control – Hierarchical decomposition of control functions – Servo and regulatory operations – Continuous and Batch processes – Mathematical Modeling of Processes: Level, Flow and Thermal processes – Lumped and Distributed parameter models – Degrees of Freedom – Interacting and non-interacting systems – Self regulation – Linearization of non-linear systems – Dynamic behavior of processes.

UNIT II CONTROL VALVE **9**

Actuators: Pneumatic and electric actuators – I/P converter – Control Valve Terminology - Characteristic of Control Valves: Inherent and Installed characteristics - Valve Positioner – Modeling of a Pneumatically Actuated Control Valve – Valve body: Commercial valve bodies – Control Valve Sizing: ISA S 75.01 standard flow equations for sizing Control Valves – Cavitation and flashing – Materials for Control Valves – Control Valve selection

UNIT III CONTROL ACTIONS **9**

Characteristic of ON-OFF, Proportional, Single speed floating, Integral and Derivative controllers – P+I, P+D and P+I+D control modes – Practical forms of PID Controller – PID Implementation Issues: Bumpless Auto/manual Mode transfer, Anti-reset windup Techniques and Direct/reverse action – Realization of PID Controller using Analog Circuits – Introduction to fractional order PID controller

UNIT IV PID CONTROLLER TUNING – SINGLE LOOP REGULATORY CONTROL & ENHANCEMENT TO SINGLE LOOP REGULATORY CONTROL **9**

PID Controller Design Specifications: Criteria based on Time Response and Criteria based Frequency Response - PID Controller Tuning: Z-N and Cohen-Coon methods, Continuous cycling method and Damped oscillation method, optimization methods, Auto tuning – Cascade control – Feed-forward control – Ratio control – Inferential control – Split-range – override control – Adaptive Control

UNIT V MODEL BASED CONTROL SCHEMES & INTRODUCTION TO MULTI-LOOP REGULATORY CONTROL & CASE –STUDIES **9**

Smith Predictor Control Scheme - Internal Model Controller – IMC PID controller – Single Loop Dynamic Matrix Control – Introduction to Multi-loop Control Schemes – Control Schemes for Distillation Column, CSTR, pH, and Heat Exchanger – Three-element Boiler drum level control – P&ID diagram.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COS)

1. Ability to understand technical terms and nomenclature associated with Process control domain.
2. Ability to build models using first principles approach as well as analyze models.
3. Ability to Design, tune and implement PID Controllers to achieve desired performance for various processes
4. Ability to Analyze Systems and design & implement control Schemes for various processes.
5. Ability to use appropriate software tools (Example: MATLAB/SCILAB) for analysis and design of Process Control System.
6. Ability to Identify, formulate and solve problems in the Process Control Domain.

TEXT BOOKS:

1 Seborg ,D.E., Mellichamp, D.P., Edgar, T.F., and Doyle,F.J., III, "Process Dynamics and Control", John Wiley and Sons, 3rd Edition, 2010.

2 Bequette, "Process Control: Modeling, Design, and Simulation", Prentice Hall of India, 2004.

REFERENCES:

1 Michael King, "Process Control: A Practical Approach", Wiley, 2010.

2. Baumann, H.D., "Control Valve Primer – A User's Guide", ISA, 2008.

3. Antonio Visioli, "Practical PID Control" Springer- Verlag London, 2006.

4. Aidan O'Dwyer, "Handbook of PI and PID Controller Tuning Rules", Imperial College Press, 2009.

5. George Stephanopoulos, "Chemical Process Control – An Introduction to Theory and Practice", Prentice Hall of India, 2005.

6. Bela G. Liptak, "Instrument Engineers' Handbook", 4th Edition, Volume Two: Process Control and Optimization, CRC Press, 2005.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1					✓	✓						
2	✓	✓		✓								
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PTEI7411 PROCESS CONTROL AND INSTRUMENTATION LABORATORY I **LT P C 0 0 4 2**

COURSE OBJECTIVES

To impart theoretical skills in

- Process Identification
- Tuning of PID controller including Auto-tuning
- PID Enhancements (Cascade and Feed-forward Control Schemes) and
- Design and Implementation of basic and advanced Control schemes using simulation software.
- To make the students aware about calibration of meter, sensors and transmitters.
- To make the students conscious about the working and operation of different types of analytical sensors.
- To identify, formulate, and analyze complex problems regarding sensors and transmitter
- To use research-based knowledge and research methods for interpretation of data from sensors

LIST OF EXPERIMENTS

Process Control

Simulation Based Experiments

1. Interpretation of P & ID (ISA S5.1)

2. Simulation of Lumped/ Distributed Parameter System.
3. Identification of Transfer function model of a Typical Industrial Process using non-parametric identification methods.
4. Design and Implementation of Practical Forms of PID Controller on the simulated model of a Typical Industrial Process.
5. Design and Implementation of Feed forward and Cascade control schemes on the simulated model of a Typical Industrial Process.
6. (i) Analysis of MIMO system.
   (ii)Design and implementation of Multi-loop PID schemes on the simulated model of a Typical Industrial Process.

Industrial Instrumentation

1. Testing of pressure gauge using dead weight tester.
2. a) Calibration of thermocouple and RTD using temperature calibrator.
   b) Calibration of temperature transmitter using multifunction calibrator.
3. Calibration of ammeter, voltmeter and wattmeter using multifunction calibrator.
4. Measurement of Absorbance and Transmittance of Test solutions using UV-Spectrometer.
5. Measurement of Conductivity, pH and Viscosity of Test solutions
6. a)Temperature Measurement using IR Thermometer.
   b) Measurement of Pressure using fiber optics system.

TOTAL : 60 PERIODS

COURSE OUTCOMES(COs)

1. Get exposed to simulation tools such as MATLAB/LABVIEW/ASPEN.
2. Be able to build dynamic models using the input-output data of a process.
3. Get acquainted with PID implementation issues and be able to tune the PID controller.
4. Ability to obtain servo and regulatory responses and be able to analyze and draw meaningful conclusions.
5. Be able to design and implement simple adaptive control scheme and model based control scheme.
6. Be able to present the results in written and oral forms.
7. Ability to work as a Member in a group.
8. Ability to experimentally measure industrial process parameters such as temperature, pressure and viscosity.
9. Ability to measure and analyze pH, conductivity, UV absorbance and transmittance.
10. Ability to calibrate sensors and transmitters.
11. Abilty to present the results in oral form as well as in written form as a report and graph.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1						✓						
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6			✓		✓							
7										✓		
8									✓			

PTEI7501 INDUSTRIAL INSTRUMENTATION III LT P C
3 0 0 3

COURSE OBJECTIVES

- To make students understand the various measuring techniques for flow and level
- To make students understand different type of transmitters.

UNIT I VARIABLE HEAD TYPE FLOWMETERS 9

Expression for flow rate through restriction(compressible and incompressible flow) – Orifice plate – different types of orifice plates – Cd variation – Pressure tapings – Venturi tube – Flow nozzle – Dall tube – Elbow taps – Pitot tube, combined pitot tube, averaging pitot tube – installation and applications of head flow meters.

UNIT II QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS 9

Positive displacement flow meters: Nutating disc, Reciprocating piston and Oval gear flow meters – Inferential meter: Turbine flow meter – Variable Area flow meter: Rota meter theory, characteristics, installation and applications – Mass flow meter: Angular momentum, Thermal and Coriolis type mass flow meters – Calibration of flow meters: Dynamic weighing method.

UNIT III ELECTRICAL TYPE FLOW METERS 9

Principle and constructional details of Electromagnetic flow meter – Ultrasonic flow meters – Laser Doppler anemometer – Vortex shedding flow meter – Target flow meter – Guidelines for selection of flow meter – Open channel flow measurement – Solid flow rate measurement.

UNIT IV LEVEL MEASUREMENT 9

Level measurement: Float gauges – Displacer type – Bubbler system – Load cell – Conductivity sensors – Capacitive sensors – D/P methods – Nucleonic gauge – Ultrasonic gauge, DIP ultrasonic sensors – Boiler drum level measurement: Differential pressure and Hydra step methods – Solid level measurement.

UNIT V TRANSMITTERS 9

Pneumatic transmitter: Operation - Electronic transmitter: Study of 2 wire and 4 wire transmitters – Operation of Electronics and Smart transmitters – Principle of operation of flow, level, temperature and pressure transmitters – Installation and Calibration of smart and conventional transmitters.

COURSE OUTCOMES

1. Ability to understand the construction, installation and working of different variable head type flow meters.
2. Able to understand the construction, working and calibration of different quantity flow meters, variable area flow meters, mass flow meters, electrical type, open channel and solid flow meters.
3. Gain knowledge about the construction, working and calibration of different type of transmitters.
4. Able to choose appropriate flow meters or level sensor for an application.

TEXT BOOKS:

1. Doebellin, E.O. and Manik D.N., “Measurement systems Application and Design”, 5 Edition, Tata McGraw-Hill Education Pvt. Ltd., 2007.
2. Patranabis, D., “Principles of Industrial Instrumentation”, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2010.

REFERENCES:

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 2005
2. Jain, R.K., “Mechanical and Industrial Measurements”, Khanna Publishers, Delhi, 1999.
3. Singh, S.K., “Industrial Instrumentation and Control”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2009.
4. Jayashankar, V., “Lecture Notes on Industrial Instrumentation”, NPTEL, E-Learning Course, IIT Madras.

PTEI7502 LOGIC AND DISTRIBUTED CONTROL SYSTEM LT P C
3 0 0 3

COURSE OBJECTIVES

- To give an overview of the automation technologies such as PLCs, SCADA and DCS used in industries.
- To provide a fundamental understanding of the different languages used for PLC programming.
- To provide insight into some of the advanced principles those are evolving for present and future automation.

UNIT I PLC & SCADA 9

PLC: Evolutions of PLCs – Programmable Controllers – Architecture, I/O modules – Comparative study of Industrial PLCs.
SCADA: Remote terminal units- Master station - Communication architectures.

UNIT II BASICS OF PLC PROGRAMMING(LADDER) 9

Basics of PLC programming – Ladder Logic – Relay type instructions – Timer/Counter instructions – Program control instructions – Data manipulation and math instructions – Programming Examples.

UNIT III PLC PROGRAMMING (OTHER LANGUAGES) 9

Functional block programming - Sequential function chart – Instruction list – Structured text programming – PLC controlled sequential Process Examples.

UNIT IV DISTRIBUTED CONTROL SYSTEM 9

DCS: Evolution & types – Hardware architecture – Field control station – Interfacing of conventional and smart field devices (HART and FF enabled) with DCS Controller – Communication modules – Operator and Engineering Human interface stations – Study of any one DCS available in market.

UNIT V ADVANCED TOPICS IN AUTOMATION 9

Introduction to Networked Control systems – Plant wide control – Internet of things – Cloud based Automation – OLE for Process Control – Safety PLC – Case studies: PLC - SCADA - DCS.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to understand all the important components such as PLC, SCADA, DCS, I/O modules and field devices of an industrial automation system.
2. Ability to develop PLC program in different languages for industrial sequential applications.
3. Able to select and use most appropriate automation technologies for a given application.
4. Ability to gain knowledge on the recent developments in industrial automation.

TEXT BOOKS:

1 Petruzella, F.D., “Programmable Logic Controllers”, 3rd Edition, Tata McGraw-Hill, 2010.

2 Lucas, M.P., “Distributed Control System”, Van Nostrand Reinhold Company, New York, 1986.

REFERENCES:

1 Clarke, G., Reynders, D. and Wright, E. "Practical Modern SCADA Protocols: DNP3, IEC 60870.5 and Related Systems", Newnes, 1st Edition, 2004.

2 Hughes, T.A., "Programmable Logic Controllers: Resources for Measurements and Control Series", 3rd Edition, ISA Press, 2004.

3 McMillan, G.K., "Process/Industrial Instrument and Controls Handbook", 5thEdition, McGraw-Hill handbook, New York, 1999.

4 NPTEL Notes on, "Programmable Logic Control System" by Department of Electrical Engg., IIT Kharagpur.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓											
2			✓									
3					✓							
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PTEI7511 PROCESS CONTROL AND INSTRUMENTATION LABORATORY II **LT P C 0 0 4 2**

COURSE OBJECTIVES

To impart theoretical skills in

- Process Identification
- Tuning of PID controller including Auto-tuning
- PID Enhancements (Cascade and Feed-forward Control Schemes) and
- Design and Implementation of basic and advanced Control schemes

  using the facilities available in the Process Control lab.
- To make the students aware about calibration of meter, sensors and transmitters.
- To make the students conscious about the working and operation of different types of analytical sensors.
- To identify, formulate, and analyze complex problems regarding sensors and transmitter
- To use research-based knowledge and research methods for interpretation of data from sensors.

LIST OF EXPERIMENTS

Process Control

Hardware Based Experiments

1. (i) Study of a Process Control Training plant.

   (ii) Determination of characteristics of a Pneumatically Actuated Control valve (with and without Positioner).

2. Design and implementation of ON-OFF controller for the Temperature Process.

3. Control of flow process using industrial type PID controller.

4. PC based control of level process.

5. On-line monitoring and control of a pilot plant using an industrial type distributed control system.

6. Design and implementation of advanced control scheme (adaptive controller or model predictive Control scheme) on the skid mounted pilot plant.

Industrial Instrumentation

1. Level measurement using d/p transmitter including elevation consideration
2. a) Calibration and configuration of smart transmitter using HART communicator.
   b) Calibration and configuration of transmitters using loop calibrator.
3. Monitor of Physiological Parameters using Vital signs monitor
4. Interfacing Different types of flow meter with PC using DAC
5. Determination of stoichiometry ratio in a combustion process.
6. a) Testing of Rotameter.b) Instillation of d/p based level Transmitter.
7. Design and Testing of Electromagnetic Flow meters.

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)

1. Gain hands on experience in working with SKID mounted pilot plants (Flow/Level/Temperature/ Pressure Control Loop(s))
2. Ability to experimentally measure industrial process parameters such as flow and level
3. Ability to measure and analyze physiological parameters such as BP, ECG and pulse rate.
4. Ability to calibrate sensors and transmitters.
5. Abilty to present the results in oral form as well as in written form as a report and graph.
6. Ability to interpret the results of analysis and draw meaningful conclusions
7. Ability to work as a member of a team while carrying out experiments.

PTEI7601 **THERMAL POWER PLANT INSTRUMENTATION** **LT P C**
3 0 0 3

COURSE OBJECTIVES

- Gain knowledge on different types of power plants.
- Study about the important process variables and their measurements.
- To understand the important control loops involved in thermal power plants.
- To analyze the various parameters related to steam turbines**.**

UNIT I OVERVIEW OF POWER GENERATION 9

Survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plant – Building blocks – Combined Cycle System – Combined Heat and Power System – sub critical and supercritical boilers.

UNIT II MEASUREMENTS IN POWER PLANTS 9

Measurement of feed water flow, air flow, steam flow and coal flow – Drum level measurement– Steam pressure and temperature measurement – Turbine speed and vibration measurement – Flue gas analyzer – Fuel composition analyzer.

UNIT III BOILER CONTROL I 9

Combustion of fuel and excess air – Firing rate demand – Steam temperature control – Control of deaerator – Drum level control: Single, two and three element control – Furnace draft control – implosion and explosion – flue gas dew point control – Trimming of combustion air – Soot blowing.

UNIT IV BOILER CONTROL II 9

Burners for liquid and solid fuels – Burner management – Furnace safety interlocks – Coal pulverizer control – Combustion control for liquid and solid fuel fired boilers – air/fuel ratio control– fluidized bed boiler – Cyclone furnace.

UNIT V TURBINE MONITORING AND CONTROL 9

Types of steam turbines – impulse and reaction turbines – compounding – Turbine governing system– Speed and Load control – Transient speed rise – Free governor mode operation – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system– Turbine run up system.

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Able to understand and analyze the process diagram of hydel, thermal, nuclear, wind and solar power plants.
2. Will be in a position to select instruments for monitoring various parameters related to thermal power plant.
3. Able to develop, analyze and select appropriate control strategy for various systems involved in thermal power plant.
4. Gain knowledge on the important terms related to turbine monitoring system and able to analyze the problems related to turbine governing.

TEXT BOOKS:

1. Sam Dukelow, “Control of Boilers”, Instrument Society of America, 1991.

2. Gill, A.B., “Power Plant performance”, Butterworth and Co (Publishers) Ltd, 2003.

REFERENCES:

1. Krishnaswamy, K. and Ponnibala, M., “Power Plant Instrumentation”, PHI Learning Pvt. Ltd., New Delhi, 2011.

2. Liptak B.G., “Instrumentation in Process Industries”, Chilton Book Company, 2005.

3. Jain R.K., “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 1999.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1		✓										
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PTEI7651 INDUSTRIAL DATA COMMUNICATION LT P C
3 0 0 3

COURSE OBJECTIVES

- To give an overview of the Industrial data communications systems.
- To provide a fundamental understanding of common principles, various standards, protocols.
- To provide insight into some of the new principles those are evolving for future networks.

UNIT I DATA NETWORK FUNDAMENTALS 9

EIA 232 interface standard – EIA 485 interface standard – ISO/OSI Reference model – Media access protocol: Command/response, Token passing and CSMA/CD – TCP/IP – Bridges – Routers – Gateways – Standard ETHERNET Configuration

UNIT II MODBUS AND HART 9

MODBUS: protocol structure, Function codes. Evolution of signal standard: HART communication protocol – Communication modes – HART Networks – HART commands – HART applications – Troubleshooting

UNIT III PROFIBUS AND FF 9

Fieldbus: Introduction – General Fieldbus architecture – Basic requirements of Fieldbus standard –

Fieldbus topology – Interoperability and Interchangeability. Profibus: Introduction – Profibus protocol stack – Profibus communication model – Communication objects – Foundation field bus versus Profibus.

UNIT IV AS – INTERFACE (AS-i), DEVICENET AND INDUSTRIAL ETHERNET 9

AS interface: Introduction – Physical layer – Data link layer – Operating characteristics. Device net: Introduction – Physical layer – Data link layer and Application layer.
Industrial Ethernet: Introduction – 10Mbps Ethernet – 100Mbps Ethernet.

UNIT V WIRELESS COMMUNICATION 9

Wireless sensor networks: Hardware components – energy consumption of sensor nodes – Network architecture – sensor network scenario. Wireless HART – Existing Wireless Options: IEEE 802.15.4 - ISA 100 – Zigbee – Bluetooth **–** their relevance to industrial applications

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Gain knowledge on various industrial data communication networks, protocols and their selection.
2. Able to select and use most appropriate networking technologies and standards for a given application.
3. Ability to design and ensuring that best practice is followed in installing and commissioning the data communications links to ensure they run fault-free.
4. Ability to understand requirements of industrial application and provide wired or wireless solution.

TEXT BOOKS:

1 Mackay, S., Wright,E., Reynders,D., and Park,J., “Practical Industrial Data Networks: Design, Installation and Troubleshooting”, Newnes Publication, Elsevier, 2004.

2 Buchanan,W., “Computer Busses: Design and Application”, CRC Press, 2000.

REFERENCES:

1 Bowden,R., “HART Application Guide”, HART Communication Foundation, 1999.

2 Bela G.Liptak, “Instrument Engineers’ Handbook, Volume 3 : Process Software and Digital Networks”, 4th Edition, CRC Press, 2011.

3 Berge,J., “Field Buses for Process Control: Engineering, Operation, and Maintenance”, ISA Press, 2004.

4 Lawrence (Larry) M. Thompson and Tim Shaw, “Industrial Data Communications”, 5th Edition, ISA Press, 2015.

5. NPTEL Lecture notes on, ”Computer Networks” by Department of Electrical Engg., IIT Kharagpur.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	F	g	h	i	j	k	l
1	✓											
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PTEI7611 INDUSTRIAL AUTOMATION LABORATORY LT P C
0 0 4 2

COURSE OBJECTIVES

To teach the importance of measurement for monitoring, control and to impart theoretical and practical skills in

- Sensor Data acquisition, Data analysis, Data processing and Data visualization.
- Interfacing Conventional and Smart Field Devices (Transmitters & Control Valves) with Industrial Type Programmable Logic Controller and Distributed Control System
- Understanding the Instruction set of Programmable Logic Controller.
- Programming of Industrial Type Programmable Logic Controller (Ladder Logic, Function Block Programming, Sequential Function Chart and Instruction List)

LIST OF EXPERIMENTS

1. Interfacing Level Transmitter and Control Valve with Personal Computer.

2. (i) Study of PLC Field Device Interface Modules (AI, AO, DI, DO Modules)
   (ii) Interfacing Analog/Digital Input/output Devices with Industrial Type PLC
3. Simple exercises using the Instruction Set of an Industrial Type PLC.

4. PLC Exercises-I (Hardware Implementation)
   i. Filling/draining control operation.
   ii. Reversal of DC motor direction.

5. PLC Exercises-II (Hardware Implementation)
   i. Traffic light control.
   ii. Alarm Annunciator Sequence.

6. Control of Level Process using an Industrial Type PLC

7. Implementation of Discrete Control Sequence in PLC using Sequential Function Chart

Programming method.

8. Implementation of Discrete Control Sequence in PLC using Instruction List Programming method.

9. (i) Study of DCS Field Device Interface Modules (AI, AO, DI, DO, H1 Modules)
   (ii) Interfacing Analog/Digital Input/Output Devices with an Industrial Type DCS
10. Implementation of Feedback Control Scheme in DCS using IEC 61131-3 Function Block Programming method.

11. (i) Interfacing HART and FF enabled Field Devices with Industrial Type DCS.
    (ii) Demonstration of PID Control in Field Devices.

12. Interfacing Wireless HART enabled Field Devices with DCS.

TOTAL : 60 PERIODS

COURSE OUTCOMES(COs)

1. Gain hands on experience in working with Industrial Automation Systems (Industrial Type DCS & PLC)
2. Be able to Configure Function Blocks and develop Feedback Control Schemes.
3. Ability to monitor and Control a pilot plant using Industrial Type DCS/PLC
4. Be able to analyze & interpret results and draw meaningful conclusions.
5. Be able to present the results in written and oral forms.
6. Ability to work as a Member in a group.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1						✓						
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4		✓		✓								
5									✓			
6									✓			

PTEI7701 INSTRUMENTATION IN PETROCHEMICAL INDUSTRY LT P C
3 0 0 3

COURSE OBJECTIVES

- To introduce the students the method of oil recovery and the steps involved in oil gas production process.
- To make the students understand the process behavior of some of the important unit operations in petrochemical industry through mathematical model.
- To familiarize the students to apply knowledge to select the appropriate control strategy for the selective process.
- To provide information about the most important derivatives obtained from petroleum products.
- To help the students in understanding selection and maintenance of instruments in petrochemical industry.

UNIT I OIL EXTRACTION AND OIL GAS PRODUCTION 9

Techniques used for oil discovery – Oil recovery methods – oil rig system - Overview of oil gas production – oil gas separation – Gas treatment and compression – Control and safety systems.

UNIT II IMPORTANT UNIT OPERATIONS IN REFINERY 9

Distillation Column – Thermal cracking – Catalytic Cracking – Catalytic reforming – mathematical Modeling and selection of appropriate control strategy – Alkylation – Isomerization.

UNIT III DERIVATIVES FROM PETROLEUM 9

Derivatives from methane – Methanol Production – Acetylene production - Derivatives from acetylene —Derivatives from ethylene – Derivatives from propylene.

UNIT IV IMPORTANT PETROLEUM PRODUCTS & MEASUREMENTS 9

BTX from Reformate – Styrene – Ethylene oxide/Ethylene glycol – polyethylene – Polypropylene – PVC production. Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments.

UNIT V SAFETY IN INSTRUMENTATION SYSTEMS 9

Hazardous zone classification – Electrical and Intrinsic safety – Explosion suppression and Deluge systems – Flame, fire and smoke detectors – leak detectors – Guidelines and standards – General SIS Design Configurations – Hazard and Risk Assessment – Failure modes – Operation and Maintenance.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Gain knowledge on oil gas production process and important unit operations in a refinery
2. Having gained the process knowledge, ability to develop and analyze mathematical model of selective processes.
3. Able to develop, analyze and select appropriate control strategy for selective unit operations in a refinery.
4. Gain knowledge on the most important chemical derivatives obtained from petroleum products.
5. Understand safety instrumentation followed in process industries.

TEXT BOOKS:

1. Waddams, A.L., “Chemicals from Petroleum”, Wiley, 1973. (digitized in 2007).

2. Balchen, J.G., and Mumme K.I., "Process Control Structures and Applications", Von Nostrand Reinhold Company, New York, 1988.

REFERENCES:

1. Liptak, B.G., "Instrumentation in Process Industries", Chilton Book Company, 2005. (Digitized in 2008.)

2. Austin, G.T. and Shreeves, A.G.T., "Chemical Process industries", McGraw-Hill, 2012.

3. Havard Devold, "Oil and Gas Production Handbook", ABB, 2006.

4. Paul Gruhn and Harry Cheddie, "Safety Instrumented Systems: Design, Analysis, and Justification", 2nd Edition, ISA Press, 2006.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	F	g	h	i	j	k	l
1	✓											
2			✓									
3					✓							
4	✓											
5	✓											

PTEI7711 **PROJECT WORK** **LT P C**
0 0 9 6

COURSE OBJECTIVES

The student should be made to:

- learn methodology to select a good project and able to work in a team leading to development of hardware/software product.
- prepare a good technical report.
- Gain Motivation to present the ideas behind the project with clarity.

A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen Comprehension of principles by applying them to a new problem which may be the design /fabrication of Sensor/Activator/Controller, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL : 135 PERIODS

COURSE OUTCOMES(COs)

At the end of the course, the student should be able to:

1. select a good project and able to work in a team leading to development of hardware/software product.
2. prepare a good technical report and able to present the ideas with clarity

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
2										✓		✓

PTGE7071 DISASTER MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXT BOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES L T P C

(Common to all branches) **3 0 0 3**

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment –

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime - the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY 9

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and chernobyl as case studies.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES

- Students will have the ability to perform with professionalism , understand their rights,legal ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics –

Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000
5. R.Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

PTGE7073 HUMAN RIGHTS LT P C
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOMES :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PTGE7074 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning--Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma Process Capability– Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.

PTGE7075 INTELLECTUAL PROPERTY RIGHTS LT P C
3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C
3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PTEI7001	ADVANCED CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The student should be made to:

- gain knowledge on the methods of plotting Nyquist chart for multivariable system.
- develop state space models.
- design state feedback control schemes and state observers.
- learn the different types of non-linearities and phase plane analysis.
- understand the different methods of determining the stability of non-linear systems.

UNIT I FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions - poles and zeros of transfer function matrices – singular value analysis – Multivariable Nyquist plots.

UNIT II STATE SPACE APPROACH 9

Review of state model for systems – State transition matrix and its properties – free and forced responses – controllability and observability – Kalman decomposition – minimal realization – balanced realization.

UNIT III STATE FEEDBACK CONTROL AND STATE ESTIMATOR 9

State Feedback – Output Feedback – Pole placement technique – Full order and Reduced Order Observers – Deadbeat Observers – Dead beat Control

UNIT IV NON-LINEAR SYSTEMS 9

Types of Non-Linearity – Typical Examples – Phase plane analysis (analytical and graphical methods) – Limit cycles – Equivalent Linearization – Describing Function Analysis, Derivation of Describing Functions for different non-linear elements.

UNIT V STABILITY OF NON-LINEAR SYSTEMS 9

Stability concepts – Equilibrium points – BIBO and Asymptotic stability – Stability Analysis by DF method – Lyapnov Stability Criteria – Krasovskil's method – Variable Gradient Method – Popov's Stability Criterion.

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- analyze MIMO systems methods of plotting Nyquist chart for multivariable system.
- analyze the state space models and capable to design state feedback control schemes and state observers.

TEXT BOOK:

1. K.Ogata, "Modern Control Engineering", PHI, 5th Edition, 2010.

REFERENCE BOOKS:

1. C.T. Chen, "Linear System Theory and Design", Prentice Hall, 3rd Edition, 2003
2. M.Gopal, "Modern Control System Theory", Wiley Eastern Limited, 2nd edition, 1996.
3. W. L. Luyben, "Process Modeling, Simulation and Control for Chemical Engineers", 2 nd edition, McGraw Hill, 1990.
4. D.P.Atherton, "Stability of non linear systems", Prentice Hall, 1986.

PTEI7002 **ADVANCED INSTRUMENTATION SYSTEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To make the students review the instruments used for measurement of basic process parameters like level, flow, pressure and temperature.
- To explore the various types of analyzers used in industrial applications.
- To make the students aware of basic concepts of safety instrumented system, standards and risk analysis techniques
- To make students familiarize with Instrumentation standards such as BS1042, ISA 75, ISA 84 and ISA 88.
- To make students familiarize with Instrumentation Symbols, Abbreviations and Identification for Instruments ,Process Flow diagrams, Instrument Loop diagrams, Instrument Hookup diagrams and Piping and Instrumentation Diagrams

UNIT I MEASUREMENT OF PROCESS PARAMETERS **9**

Measurement of temperature, pressure, flow and level – application - selection – calibration methods.

UNIT II INSTRUMENTS FOR ANALYSIS **9**

Ion selective electrodes - Gas & Liquid Chromatography - Oxygen analyzers for gas and liquid –CO,CO2 ,NO and SO Analyzers- Hydrocarbon and H2S Analyzers – Dust, smoke, Toxic gas and radiation monitoring.

UNIT III SAFETY INSTRUMENTATION **9**

Introduction to Safety Instrumented Systems – Hazards and Risk – Process Hazards Analysis (PHA) – Safety Life Cycle – Control and Safety Systems - Safety Instrumented Function - Safety Integrity Level (SIL) – Selection, Verification and Validation.

UNIT IV INSTRUMENTATION STANDARDS **9**

Instrumentation Standards - significance of codes and standards – overview of various types - Introduction of various Instrumentation standards – review, interpretation and significance of specific standards - examples of usage of standards on specific applications.

UNIT V DOCUMENTATION IN PROCESS INDUSTRIES **9**

Block Diagram of a Typical Process – Instrumentation Symbols, Abbreviations and Identification for Instruments: - Mechanical Equipment, Electrical Equipment, Instruments and Automation Systems - Process Flow Diagram (PFD) – Piping and Instrumentation Diagram (P&ID) - Instrument Lists and Specification – Logic Diagrams – Instrument Loop Diagrams - Instrument Hookup Diagrams – Location Plans for Instruments - Cable Routing Diagrams – Typical Control /Rack Rooms Layout – Vendors Documents and Drawings

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

students will be able to

- understand the instrumentation behind flow, level, temperature and pressure measurement
- acquire basic knowledge on the various types of analyzers used in typical industries.
- understand the role of Safety instrumented system in the industry.
- explain Standards for applying Instrumentation in Hazards Locations.
- Design, develop, and interpret the documents used to define instruments and control systems for a typical project, including P&IDs, loop diagrams, specification forms, instrument lists, logic diagrams, installation details, and location plans

REFERENCE BOOKS

1. B.G.Liptak, "Instrumentation Engineers Handbook (Process Measurement & Analysis)", Fourth Edition, Chilton Book Co, CRC Press, 2005.
2. Al.Sutko,Jerry.D.Faulk, "Industrial Instrumentation", Delmar publishers, 1996.
3. Paul Gruhn, P.E., CFSE and Harry Cheddie, P.E., "Safety Instrumented Systems: Design, Analysis, and Justification", 2nd Edition, ISA,2006.
4. Safety - ANSI/ISA84.00.01-2004, Part 1: Framework, Definitions, System Hardware and Software Requirements; ANSI/ISA84.00.01-2004, Part 2: Functional Safety: Safety Instrumented Systems for the Process Industry Sector; ANSI/ISA84.00.01-2004, Part 3: Guidance for the Determination of the Required Safety Integrity Levels-Informative.
5. Standards - ANSI/ISA-75.01.01 -2002 (60534-2-1 Mod): Flow Equations for Sizing control Valves; ISA84 Process Safety Standards and User Resources, Second Edition, ISA, 2011; ISA88 Batch Standards and User Resources, 4th Edition, ISA, 2011.
6. Documentation Standards - ANSI/ISA5.4-1991 - Instrument Loop Diagrams; ANSI/ISA5.06.01-2007 - Functional Requirements Documentation for Control Software Applications; ANSI/ISA20-1981 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.

PTEI7003 ADVANCED TOPIC IN PID CONTROL L T P C
3 0 0 3

COURSE OBJECTIVES

- To provide an overview of the features associated with Industrial type PID controller.
- To make the students understand the various PID Controller Design methods and about PID stabilization for Linear Time-invariant models.
- To develop the skills needed to design adaptive and non-linear PID control schemes.
- To provide basic knowledge about Fractional-order systems and Fractional-order- controller and to lay the foundation for the systematic approach to Design controller for fractional order systems.

UNIT I INTRODUCTION 9

Evolution of PID controller – PID Controller Structures – PID Implementation Issues – Tuning of PID Controller using Classical Approaches.

UNIT II PID CONTROLLER DESIGN 9

PID Controller Design Techniques : Pole placement, Lamda Tuning, Direct Synthesis, Gain Margin & Phase Margin and Optimization methods - Auto-Tuning.

UNIT III PID STABILIZATION 9

Stabilization of Linear Time-invariant Plants using P/PI/ PID controllers – Optimal Design using PID Controllers – Robust and Non-fragile PID Controller Design.

UNIT IV ADAPTIVE/NON-LINEAR PID CONTROL SCHEMES 9

Gain Scheduled PID Controller - Self-tuning PI/PID Controller – PID Types Fuzzy Logic Controller – Predictive PID Control.

UNIT V INTRODUCTION TO FRACTIONAL ORDER SYSTEM AND FRACTIONAL ORDER PID CONTROLLER 9

Fractional-order Calculus and Its Computations – Frequency and Time Domain Analysis of Fractional-Order Systems - Filter Approximations to Fractional-Order Differentiations –Model reduction Techniques for Fractional Order Systems – Fractional Order PI/PID Controller Design.

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Ability to determine the advanced Features supported by the Industrial Type PID Controller.
2. Ability to Design, tune and implement P/PI/PID Controllers to achieve desired Performance for various processes.
3. Ability to design and implement adaptive PID controllers and Non-linear PID Control schemes.
4. Ability to Analyze Fractional-order systems, Fractional-order- controller and Design controller for fractional order systems.

TEXT BOOKS:

1. Karl J. Astrom and Tore Haggland, “Advanced PID Control”, ISA Publications, 2005.

2. Aniruddha Datta, Ming-Tzu Ho, and Shankar P. Bhattacharyya, “Structure and Synthesis of PID Controllers”, Advances in Industrial Control, Springer Verlag London, 2000.

REFERENCES:

1. Antonio Visioli, “Practical PID Control” Springer- Verlag London, 2006

2. Aidan O’ Dwyer, “Handbook of PI and PID Controller Tuning Rules”, Imperial College Press, 2009.

3. Xue, D., Chen, Y.Q., and Atherton, D.P., "Linear Feedback Control Analysis and Design with MATLAB, Advances in Design and Control", Society for Industrial and Applied Mathematics, 2008.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/ PO	a	b	c	d	e	f	g	h	i	j	k	l
1					✓							
2	✓	✓	✓	✓	✓							
3	✓		✓	✓	✓			✓				
4	✓		✓	✓	✓			✓				

PTEI7004 **APPLIED SOFT COMPUTING** **LT P C**
3 0 0 3

COURSE OBJECTIVES

- Get familiarized with different architectures and training algorithms of neural networks.
- Get exposed to the various neural modeling and control techniques with case study using simulation tool box.
- Gain Knowledge on fuzzy set theory and fuzzy rules.
- Able to design and implement the fuzzy logic controller with case study using simulation tool box.
- Capable of designing hybrid control schemes, selected optimization algorithms with case study using simulation tool box.

UNIT I ARTIFICIAL NEURAL NETWORK (ANN) 9

Introduction to ANN: Biological neuron, artificial neuron, activation function, Perceptron – Multi layer perceptron – Back propagation algorithm (BPA) – Recurrent neural network (RNN) – Adaptive resonance theory (ART) based network – Radial basis function (RBF) network – Online learning algorithms: BPA through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL 9

Need for using ANN in Modeling and Control – Modeling of non-linear systems using ANN: Generation of training data, Identification of Optimal architecture, Model validation – Control of non-linear systems using ANN: Direct and Indirect neuro control schemes – Adaptive neuro controller – Case study – Familiarization with neural network toolbox.

UNIT III FUZZY SET THEORY 9

Fuzzy set theory – Operation on fuzzy sets: Scalar cardinality, Fuzzy cardinality, Fuzzy union and intersection Fuzzy complement (Yager and Sugeno), Equilibrium points, Aggregation, Projection, Composition, Cylindrical extension, Fuzzy relation – Fuzzy membership functions .

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL 9

Modeling of non-linear systems using fuzzy models: TSK model – Fuzzy logic controller: Fuzzification, Knowledge base, Decision making logic, Defuzzification – Adaptive fuzzy systems – Case Study – Familiarization with fuzzy logic toolbox.

UNIT V HYBRID CONTROL SCHEMES 9

Need for Hybrid control – Neuro-Fuzzy Control scheme – ANFIS – Case study – Familiarization with ANFIS toolbox – Introduction to Genetic Algorithm and Particle swarm optimization – Optimization of membership function and rule base using Genetic Algorithm – Introduction to Support vector machine.

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Be able to analyze problems to formulate models and develop control schemes using soft computing techniques for non-linear systems.
2. Be able to apply engineering fundamentals to use hybrid schemes and optimization algorithms to obtain solution for complex engineering problems.
3. Be capable of using modern IT tool boxes to simulate case studies

TEXT BOOKS :

1. Fausett, L.V., "Fundamentals of Neural Networks, Architecture, Algorithms and Applications", Pearson Education, 2008.

2. Ross, T.J., "Fuzzy Logic with Engineering Applications", Wiley, 3rd Edition, 2010.

REFERENCES:

1. Goldberg, D.E., "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Longman Publishing Company Inc. 1989.

2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992.

3. Klir G.J., and Bo, Yuan, "Fuzzy sets and fuzzy logic, Theory and applications", Prentice Hall, 1995.

4. Ethem Alpydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)", MIT Press, 2004.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓	✓										
2	✓											
3					✓							

PTEI7005	BIO MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To make students understand various physiological signal measurements, Identification and classification.
- To make students understand various Biomedical Instruments used for Bio-potential measurement and non-electrical parameter measurement.
- To make students familiarized with the medical imaging and understanding the concept of assisting and therapeutic devices.

UNIT I BASIC CONCEPTS OF MEDICAL INSTRUMENTATION 9

Terminology of medicine and medical devices – Generalized medical Instrumentation systems – Classification of Biomedical instruments – Medical measurement constraints – Interfering and modifying inputs – Compensation Techniques – Bio-statics – Design criteria – Transducers Selection criteria – The origin of Bio-potentials – Electrical activity of excitable cells – Volume conductor fields – Bio-potential Electrodes: The electrode-Electrolyte interface, Polarization: Polarizable and non-polarizable electrodes, Electrode behavior and circuit models, Electrode arrays, Surface and Microelectrodes.

UNIT II ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Types and Classification of biological signals – Electrical parameters acquisition: Origin, recording schemes and analysis of biomedical signals – ECG, EEG, EMG, ERG – Lead systems and recording methods – Typical waveforms – Noise and artifacts – Electrical safety in medical environment: Physiological Effect of Electrical Current, shock hazards – leakage current – Instruments for checking safety parameters of biomedical equipment.

UNIT III NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure – Cardiac output – Blood flow – Heart rate – Heart sound – Pulmonary function measurements – Spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analyzers, pH of blood – Measurement of blood pCO2, pO2, finger-tip oximeter – ESR, GSR measurements.

UNIT IV MEDICAL IMAGING SYSTEMS 9

X-ray machine- Computer radiography – Computer tomography – Magnetic resonance imaging – Nuclear medicine – Single photo emission computer tomography – Positron emission tomography – Ultrasonography – Endoscopy – Thermal Imaging.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers – Lithotripsy – Therapeutic and Prosthetic Devices – Infant Incubators – Drug Delivery Devices – Surgical Instruments.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Able to understand the operation of different medical devices.
2. Able to measure and analyze the Biological signals.

3. Able to apply these instruments in diagnosis, therapeutic treatment and imaging fields.

TEXT BOOKS:

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, 4th Edition New York, 2009.

2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

REFERENCES:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, 3rd Edition, New Delhi, 2014.

2. Ed. Joseph D. Bronzino, "The Biomedical Engineering Hand Book", 2nd Edition, Boca Raton, CRC Press LLC, 2000.

3. Joseph J. Carr and John M. Brown," Introduction to Biomedical Equipment Technology", John Wiley and sons, 4th Edition, New York, 2000.

4. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., "Health Care Systems, Technology and Techniques", Springer, 1st Edition, 2011.

5. Duane Knudson," Fundamentals of Biomechanics", Springer, 2003.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO\PO	a	b	c	d	e	F	g	h	i	j	k	l
1	✓		✓	✓	✓							
2	✓		✓	✓	✓							
3					✓	✓						✓

PTEI7006 **DISCRETE TIME SIGNAL PROCESSING** **LT P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts of Digital Signal processing.
- To make the students familiarize various mathematical tools for analyzing Discrete Time Systems.
- To make the students design Digital Filters based on the Filter specifications.
- To provide the exposure to the architectures of DSP processors.
- To implement various algorithms in DSP for solving Real-time problem.

UNIT I INTRODUCTION **9**

Digital signal processing: Block diagram, advantages and applications, Linear and circular convolution, convolution techniques for long duration sequence, autocorrelation and cross correlation, aliasing effects in time domain – Review of DTFS, DTFT and Z-Transform.

UNIT II DFT AND FFT **9**

DFT properties, magnitude and phase representation – Direct computation of DFT – FFT: Radix 2 DIT & DIF algorithms, computational complexity, DFT and IDFT using FFT algorithms.

UNIT III DIGITAL IIR FILTERS **9**

Introduction, design procedures for digital IIR filters, frequency transformation techniques – Digital Butterworth and Chebyshev IIR filter design using impulse invariant and bilinear transformation – Realization of IIR filters.

UNIT IV DIGITAL FIR FILTERS **9**

Introduction, advantages of FIR over IIR filters - linear phase filters – Windowing technique: Rectangular, Triangular, Hamming, Hanning and Kaiser windows – Realization of FIR filter structures.

UNIT V FINITE WORD LENGTH EFFECTS AND DSP PROCESSORS **9**

Finite word length Effect – Fixed and floating point number representation, Quantization errors – Finite word length effects in IIR and FIR filters – Introduction to DSP architectures – addressing modes and Instruction set.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

- Ability to apply various mathematical tools for analyzing discrete time system based on the knowledge of mathematics
- Ability to design digital filters.
- Ability to come out with solutions for solving simple/complex problem.
- Ability to use DSP Processor for real-time implementation.

TEXT BOOKS:

1. Proakis, J.G., and Manolakis, D.G., "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, New Delhi, 2003 / PHI.

2. Johnson, J.R., "Introduction to Digital Signal Processing", Prentice Hall of India, 2009.

REFERENCES:

1. Mitra, S.K., "Digital Signal Processing" – A Computer Based Approach, Tata McGraw-Hill, 2001.
2. Uyemura, J.P., "A first course in Digital System Design An integrated approach", Cengage Learning, 2000.
3. Lonnie C.Ludeman, "Fundamentals of Digital Signal Processing" John Wiley & Sons,1986.
4. NPTEL Video Lecture series on, "Digital Signal Processing" by Prof. S.C. Dutta Roy, IIT Delhi.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓											
2			✓									
3			✓									
4					✓							

PTEI7007 FAULT DETECTION AND DIAGNOSIS LT P C
3 0 0 3

COURSE OBJECTIVES

- To give an overview of different Fault Detection and Diagnosis methods.
- To present an overview of various types of fault detection schemes using Limit Checking, Parameter estimation methods, Principle Component Analysis.
- To impart knowledge and skills needed to design and detect sensor and actuators faults using structured residual approach as well as directional structured residual approach.
- To impart knowledge and skills needed design and detect faults in sensor and actuators using GLR and MLR based Approaches.
- To impart knowledge and skills needed to detect and quantify and compensate stiction in Control valves.

UNIT I INTRODUCTION & ANALYTICAL REDUNDANCY CONCEPTS 9

Introduction – Types of faults and different tasks of Fault Diagnosis and Implementation – Different

approaches to FDD: Model free and Model based approaches-Introduction- Mathematical representation of Faults and Disturbances: Additive and Multiplicative types – Residual Generation: Detection, Isolation, Computational and stability properties – Design of Residual generator – Residual specification and Implementation.

UNIT II FAULT DETECTION AND DIAGNOSIS USING LIMIT CHECKING AND PROCESS IDENTIFICATION METHODS **9**

Limit Checking of absolute values – Trend Checking – Change detection using binary thresholds – adaptive thresholds – Change detection with Fuzzy thresholds – Fault detection using Process Identification methods and Principle Component Analysis.

UNIT III FAULT DETECTION AND DIAGNOSIS USING PARITY EQUATIONS **9**

Introduction – Residual structure of single fault Isolation: Structural and Canonical structures- Residual structure of multiple fault Isolation: Diagonal and Full Row canonical concepts – Introduction to parity equation implementation and alternative representation - Directional Specifications: Directional specification with and without disturbances – Parity Equation Implementation.

UNIT IV FAULT DIAGNOSIS USING STATE ESTIMATORS **9**

Introduction – Review of State Estimators – Fault Detection and Diagnosis using Generalized Likelihood Ratio Approach and Marginalized Likelihood Ratio Approach

UNIT V CASE STUDIES **9**

Fault detection and diagnosis of DC Motor Drives – Fault detection and diagnosis of a Centrifugal pump-pipe system – Fault detection and diagnosis of an automotive suspension and the tire pressures - Automatic detection, quantification and compensation of valve stiction.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs) :

1. Ability to explain different approaches to Fault Detection and Diagnosis.
2. Ability detect faults using Limit Checking, Parameter estimation methods, Principle Component Analysis.
3. Ability to design and detect sensor and actuators faults using structured residual approach as well as directional structured residual approach.
4. Ability to design and detect faults in sensor and actuators using GLR and MLR based Approaches.
5. Ability to detect and quantify and compensate stiction in Control valves.

TEXT BOOKS:

1 Janos J. Gertler, “Fault Detection and Diagnosis in Engineering systems”, 2nd Edition, Marcel Dekker, 1998.

2 Rolf Isermann, **“**Fault-Diagnosis Systems an Introduction from Fault Detection to Fault Tolerance”, Springer Verlag, 2006.

REFERENCES:

1 Steven X. Ding, “Model based Fault Diagnosis Techniques: Schemes, Algorithms, and Tools”, Springer Publication, 2012.

2 Hassan Noura, Didier Theilliol, Jean-Christophe Ponsart and Abbas Chamseddine, "Fault-Tolerant Control Systems: Design and Practical Applications", Springer Publication, 2009.

3. Mogens Blanke, "Diagnosis and Fault-Tolerant Control", Springer, 2006.

4. Ali Ahammad Shoukat Choudhury, Sirish L. Shah and Nina F. Thornhill, "Diagnosis of Process Nonlinearities and Valve Stiction: Data Driven Approaches", Springer, 2008.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/ PO	a	b	c	d	e	f	g	h	i	j	k	l
1					✓							
2	✓	✓	✓	✓	✓							
3	✓	✓	✓	✓	✓							
4	✓	✓	✓	✓	✓							
5	✓	✓	✓	✓	✓							

PTEI7008 FIBRE OPTICS AND LASER INSTRUMENTATION L T P C
3 0 0 3

COURSE OBJECTIVES

- To discuss about theory behind light propagation in optical fibers, types of optical fibers, dispersion characteristics for various types of optical fibers and attenuation measurement system.
- To provide an overview of recent advances in fiber optic sensor technology.
- To provide knowledge on principle of laser generation, laser system and its types.
- To emphasize how lasers have been used for industrial applications.
- To acquaint the students with fundamentals of holography.

UNIT I OPTICAL FIBER AND THEIR PROPERTIES 9

Principles of light propagation through a fiber – laws related to light propagation through fiber – Different types of fiber and their properties, Fiber manufacture – mechanical and transmission characteristics – Connectors & splicers – Fiber termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICALFIBER 9

Fiber optic sensors – Fiber optic instrumentation system for measurement of fiber characteristics – Different types of modulators – Interferometric method for measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain – fiber optic gyroscope – Polarization Maintaining fibers.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers, Excimer lasers, VCSEL .

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Material Removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle – Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers – laser and tissue interaction – Laser instruments for surgery – removal of tumours of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Understand the principle, transmission, dispersion and attenuation characteristics of optical fibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
3. Understand laser theory and laser generation system.
4. Students will gain ability to apply laser theory for the selection of lasers for a specific Industrial and medical application.

TEXT BOOKS:

1. Keiser, G., “Optical Fiber Communication”, McGraw-Hill, 3rd Edition, 2000.

2. Eric Udd, William B., and Spillman, Jr., “Fiber Optic Sensors: An Introduction for Engineers and Scientists “, John Wiley & Sons, 2011.

REFERENCES:

1. John and Harry, “Industrial lasers and their application”, McGraw-Hill, 2002.

2. John F. Ready, “Industrial Applications of Lasers”, Academic Press, Digitized in 2008.

3. Monte Ross, “Laser Applications”, McGraw-Hill, 1968.

4. NPTEL lecture on “Advanced optical communication” by R.K. Shevgaonkar, IIT Bombay.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	F	g	h	i	j	k	l
1	✓											
2			✓									
3	✓											
4			✓									

PTEI7009 FUNDAMENTALS OF NANO SCIENCE AND MEMS LT P C
3 0 0 3

COURSE OBJECTIVES

- To provide wide information dealing with nano material and its necessity.
- To understand the impact of various steps needed to be followed in nano material preparation.
- To analyze methods involving preparation of nano scale devices.
- To provide knowledge about working nature and neighborhood condition regarding the preparation.
- To Explore the properties of various types of nano materials.

UNIT I INTRODUCTION 9

Nano scale Science and Technology – Implications for Physics, Chemistry, Biology and Engineering – Classifications of nano structured materials – nano particles – quantum dots, Nano wires – ultra-thin films – multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS 9

Bottom-up Synthesis – Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 9

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography.

UNIT IV PREPARATION ENVIRONMENTS 9

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues,
flammable and toxic hazards, biohazards.

UNIT V CHARECTERISATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy – environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Will be familiar with various preparation methods of nano material
2. Will be in a position to learn and keep in pace with recent nano scale materials
3. To draw well-founded conclusions applying the knowledge acquired from research and research methods of nano science and MEMS.

TEXT BOOKS:

1. Mickwilson et al, “Nano Technology: Basic science and Emerging Technologies”, Chapman &

Hall/CRC Press, 2004.

2. Jeremy J.Ramsden, “Nano Technology: an Introduction”, Elsevier Publication, 2011.

REFERENCES:

1. Edelstein, A.S., and Cammearata, R.C., eds., “Nano materials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.

2. John Dinardo, N., “Nano scale characterization of surfaces & Interfaces”, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.

3. Timp, G., (Editor), “Nanotechnology”, AIP press/Springer, 1999.

4. Akhlesh Lakhtakia (Editor), “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1		✓	✓									
2								✓				✓
3			✓									
4												
5												

PTEI7010 FUNDAMENTALS OF PNEUMATICS AND HYDRAULICS L T P C

3 0 0 3

COURSE OBJECTIVES

- To introduce the fundamentals of hydraulic and pneumatic systems and their applications.
- To provide knowledge about the components involved in hydraulic and pneumatic systems.
- To select the control strategy for hydraulic and pneumatic systems.
- To gain basic safety precaution for hydraulic and pneumatic systems.
- To understand the concept of interfacing these systems with PLC and various microcontrollers.

UNIT I FLUID POWER PRINCIPLES AND FUNDAMENTALS 9

ntroduction to fluid power – Advantages and Applications – Fluid power systems – Types of fluids –Properties of fluids – Basic of Hydraulics: Pascal's Law,Principles of flow ,work, Power and Torque. Properties of air – Perfect Gas Laws.

9

UNIT II HYDRAULIC SYSTEM AND COMPONENTS

Pumping Theory – Pump Classification – Fixed and Variable displacement Pumps: Working, Advantages, Disadvantages and Performances. Hydraulic Actuators: Cylinders, Types and Construction Hydraulic motors – Performance charts. Accessories – Accumulator and Intensifiers.

UNIT III CONTROL OF HYDRAULIC SYSTEMS 9

Control Components: Direction control, flow control and pressure control valves – Types, Applications – Types of actuation – Pressure Switches – Fluid power ANSI Symbol. Industrial Hydraulic circuits – Regenerative, Double-Pump, sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control – Hydrostatic Transmission.

9

UNIT IV PNEUMATIC SYSTEM

Compressors – Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators – Introduction to Fluidics – Pneumatic logic circuits AND,OR, MEMORY, etc.

UNIT V ELECTRO HYDRALIC AND ELECTROPNEUMATIC CIRCUITS 9

Sequential circuits – design for simple applications using cascade method – Electro Pneumatic circuits – Microprocessor and PLC – Applications in Hydraulic and Pneumatics – Low cost Automation – Hydraulic and Pneumatic Power Packs – Installation, Fault finding and Maintenance.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to select hydraulic or pneumatic components and to design for automation.
2. Gain knowledge on control of hydraulic and pneumatic systems.
3. Ability to select proper control scheme for the given applications.
4. Capable of proper installation, fault finding and maintenance of hydraulic and pneumatic systems.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", 7th edition, Pearson education, 2014.
2. Srinivasan, R., "Hydraulic and Pneumatic Controls", 2nd edition, Vijay Nicole Imprints, 2008.

REFERENCES:

1. William W. Reaves, "Technology of Fluid Power", Delmer Publishers, 1997.
2. Petor Rohner, "Fluid power logic circuit Design", Macmillon Press Ltd, 1990.
3. Andrew Parr,"Hydraulics & Pneumatics", Jaico Publishing House, 2004.
4. Majumdar, "Oil Hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004.
5. Majumdar, "Pneumatic system: Principles and Maintenance", Tata McGraw Hill, 2004.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	L
1					✓							
2	✓											
3					✓							
4					✓							

PTEI7011 INSTRUMENTATION STANDARDS

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3	0	0	3

COURSE OBJECTIVES

- To impart basic knowledge on Instrumentation standards.

UNIT I STANDARDS ORGANIZATION **9**

Standards: Introduction International and National Standards organization: IEC, ISO, NIST, IEEE, ISA, API, BIS, DIN, JISC and ANSI.

API: Process Measurement and Instrumentation (APIRP551): recommended practice for installation of the instruments – flow, level, temperature, pressure - Process Instrument and Control (API RP554): performance requirements and considerations for the selection, specification, installation and testing of process instrumentation and control systems.

UNIT II ISA STANDARDS **9**

Documentation of Measurement and Control, Instruments and System (ISA 5): 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7 - General Requirements for Electrical Equipment in Hazardous Location (ISA 12):

12.2, 12.4, 12.24, 12.29 – Instrument Specification Forms (ISA20): – Measurement Transducers (ISA37)

UNIT II ISA STANDARDS - CONTROL VALVE AND ACTUATOR 9

Control Valve Standards (ISA75): 75.01, 75.04, 75.05, 75.7, 75.11, 75.13, 75.14, 75.23, 75.24, 75.26.

Valve Actuator (ISA 96): 96.01, 96.02, 96.03, 96.04.

9

UNIT IV ISA STANDARDS - FOSSIL AND NUCLEAR POWER PLANTS

Fossil Power Plant Standards (ISA 77): 77.14, 77.22, 77.30, 77.41, 77.42, 77.44, 77.60, 77.70. Nuclear Power Plant Standards (ISA67): 67.01, 67.02, 67.03, 67.04, 67.06.

UNIT V BS , ISO, IEC, & ANSI 9

Measurement of Fluid Flow by means of Orifice Plates (ISO 5167/ BSI042) IEC 61131-3 – Programmable Controller – Programming Languages – Specification for Industrial Platinum Resistance Thermometer Sensors (BSI904) – International Thermocouple Reference Tables (BS4937) – Temperature Measurement Thermocouple (ANSIC96.1)

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to understand the role of standards organization.
2. Ability to interpret and follow different standards while carrying out installation of sensors, transmitters, Industrial automation systems, PLC programming, documentation, equipment selection in hazardous area and instrument specification forms.
3. Ability to understand and follow different standards while performing control valve sizing, actuator sizing and orifice sizing etc.
4. Ability to interpret and follow different standards while carrying out monitoring and control of fossil fuel power plants and nuclear power plants.

TEXT BOOKS:

1. API Recommended Practice 551, “Process Measurement Instrumentation”, American Petroleum Institute, Washington, D.C., 1st Edition, May 1993.

2. API Recommended Practice 554, “Process Instrumentation and Control – 3 parts”, American Petroleum Institute, Washington, D.C., 1st Edition, October 2008.

3. ISA standard 5, “Documentation of Measurement and Control Instruments and Systems”, ISA, North Carolina, USA.

4. ISA standard 12, “Electrical Equipment for Hazardous Locations”, ISA, North Carolina, USA.

5. ISA standard 20, “Instrument Specification Forms”, ISA, North Carolina, USA.

6. ISA standard 37, “Measurement Transducers”, ISA, North Carolina, USA.

7. ISA standard 75, “Control Valve Standards”, ISA, North Carolina, USA.

8. ISA standard 96, “Valve Actuator”, ISA, North Carolina, USA.

9. ISA standard 77, “Fossil Power Plant Standards”, ISA, North Carolina, USA.

10. ISA standard 67, “Nuclear Power Plant Standards”, ISA, North Carolina, USA.

11. BS EN 60584-1, “Thermocouples - EMF specifications and tolerances”, British Standard, 2013.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO\PO	a	b	c	d	e	f	g	h	i	j	k	l
1						✓	✓					
2			✓		✓	✓	✓					
3			✓		✓	✓	✓					
4	✓		✓		✓	✓	✓					

PTEI7012 INSTRUMENTATION SYSTEM DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on the design of signal conditioning circuits for the measurement of Level, temperature and pH.
- To develop the skills needed to design, fabricate and test Analog/ Digital PID controller, Data Loggers and Alarm Annunciator
- To make the students familiarize design orifice and control valve sizing.

UNIT I DESIGN OF SIGNAL CONDITIONING CIRCUITS 9

Design of V/I Converter and I/V Converter- Analog and Digital Filter design – Signal conditioning circuit for pH measurement –Compensation circuit - Signal conditioning circuit for Temperature measurement - Cold Junction Compensation – software and Hardware approaches -Thermocouple Linearization – Software and Hardware approaches

UNIT II DESIGN OF TRANSMITTERS 9

RTD based Temperature Transmitter – Thermocouple based Temperature Transmitter- Design of Capacitance based Level Transmitter – Air-purge Level Measurement – Design of Smart Flow Transmitters.

UNIT III DESIGN OF DATA LOGGER AND PID CONTROLLER 9

Design of ON / OFF Controller using Linear Integrated Circuits- Electronic PID Controller – Microcontroller Based Digital PID Controller - Micro - controller based Data Logger – Design of PC based Data Acquisition Cards

UNIT IV ORIFICE AND CONTROL VALVE SIZING 9

Orifice Sizing: - Liquid, Gas and steam services - Control Valves – Valve body:- Commercial valve bodies – Control valve sizing – Liquid, Gas and steam Services – Cavitation and flashing – Selection criteria – Rotameter Design.

UNIT V DESIGN OF ALARM AND ANNUNCIATION CIRCUIT 9

Alarm and Annunciation circuits using Analog and Digital Circuits – Thyristor Power Controller – Design of Programmable Logic Controller

TOTAL : 45 PERIODS

COURSE OUTCOMES

Ability to design signal conditioning circuits for temperature sensors, V/I and I/V converters

- Ability to design and fabricate smart transmitters
- Ability to design, fabricate and test PID controllers and alarm circuits
- Ability to carry out orifice and control valve sizing for Liquid/Steam Services

REFERENCE BOOKS

1. C. D. Johnson, “Process Control Instrumentation Technology”, 8th Edition, Prentice Hall, 2014.
2. Control Valve Handbook, 4th Edition, Emerson Process Management, Fisher Controls International, 2005.
3. R.W. Miller, “Flow Measurement Engineering Handbook”, Mc-Graw Hill, New York 1996.
4. Bela G. Liptak, “Instrument Engineers Handbook - Process Control and Optimization”, 4th Edition, Vol.2, CRC Press,2008.
5. Thakore and Bhatt ,”Introduction to Process Engineering and Design” , TATA McGraw-Hill,2007.

PTEI7013	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the principles of IoT and the IoT Enabling Technologies
- To impart knowledge about the Internet principles
- To Enable the students to understand the design methodologies for IoT
- To impart the fundamentals of servers and clouds
- To familiarize the students with some of the important and advanced topics in IoT

UNIT I INTRODUCTION TO IOT **9**

Definition and Characteristics - IoT enabling technologies – Levels of deployment – Domain specific IoTs - SDN and NFV for IoT – Overview of IIOT and M2M

UNIT II INTERNET PRINCIPLES **9**

ISO/OSI model – MAC address and IP address -Overview of TCP/IP and UDP -Basics of DNS - Classes of IP addresses - Static and dynamic addressing –Salient features of IPV4 – Specifications of IPV6 and 6LoPAN.

UNIT III IOT DESIGN METHODOLOGY **9**

Requirements and Specifications – Device and Component Integration – Logical Design using open source Operating System –Physical design using prototyping boards - Sensors and actuators, choice of processor, interfacing and networking - Techniques for writing embedded code - Case studies and examples using Python programming and Arduino/Raspberry Pi prototyping boards.

UNIT IV SERVERS AND CLOUDS FOR IOT **9**

Introduction to cloud storage models and communication APIs – Web application framework – Designing a web API – Web serices - IoT device management –Application layer protocols for IoT.

UNIT V ADVANCED TOPICS **9**

Big Data analytics for IoT – Batch data analysis and Real time data analysis – Security in IoT – Security levels – Ethics in IoT Design - Case studies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

- Acquire knowledge about the basics of IoT enabling technologies and the levels of IoT deployments
- Understand the characteristics of Internet protocol
- Ability to design and develop simple IoT applications
- Acquire knowledge about Clouds and Servers that are used in IoT design
- Familiarize with advanced topics in IoT design such as Data analytics, Security and Ethics

REFERENCE BOOKS

1. "Internet of Things A Hands-on Approach", ArshdeepBahga and Vijay Madisetti, Universities Press (India), 2015.
2. "Designing the Internet of Things", Adrian McEwen and Hakim Cassimally, John Wiley &Sons, 2014.
3. "Rethinking the Internet of Things, Francis Dacosta, Apress Open, 2013.

PTEI7014 MICRO CONTROLLER BASED SYSTEM DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on PIC microcontroller and ARM processor.
- To introduce the architecture and instruction set of PIC 16F87x.
- To make them familiar with ports, timer, CCP modules, interrupts, peripherals and interfacing of PIC 16F87x.
- To introduce the architecture and assembly language programming of ARM LPC 2148.
- To make them learn the ARM organization and instruction set.

UNIT I PIC INTRODUCTION 9

Introduction to PIC Microcontroller – PIC 16F87x Architecture –Instruction Set – Simple Operations.

UNIT II PORTS, COUNTERS, TIMER, CCP MODULE AND INTERRUPTS 9

PIC16F87I2C I/O Ports, Counters, Timers CCP Modules –Interrupts.

UNIT III PERIPHERALS AND INTERFACING 9

16F87xI2C Bus Peripherals Chip Access – Analog to Digital Converter – UART.

UNIT IV ARM LPC2148 INTRODUCTION 9

ARM LPC2148 Architecture – ARM LPC2148 Development tools – ARM Assembly Languages Programming – Simple Examples.

UNIT V ARM LPC2148 ORGANIZATION 9

3-Stage Pipeline ARM Organization – 5-Stage Pipeline ARM Organization – ARM Implementation – ARM Instruction Set.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Able to apply the knowledge of PIC microcontroller and ARM processor to solve simple operations.
2. Able to apply the microcontroller programming skills to design and carry out projects which will be useful for the society.
3. Ability to identify and formulate engineering problems and should be in a position to use the microcontrollers appropriately.
4. Ability to formulate and work in multidisciplinary projects.
5. Capability to learn and keep in pace with latest microcontrollers .

TEXT BOOKS

1. Peatman, J.B., “Design with PIC Micro Controllers”, Pearson Education, 3rd Edition, 2004.
2. Furber, S., “ARM System on Chip Architecture”, Addison Wesley trade Computer Publication, 2000.

REFERENCES

1. Andrew N. Sloss, Dominic Symes and Chris Wright, “ARM System Developer’s Guide: Designing and Optimizing System Software”, Elsevier Inc., 2013.
2. Trevor Martin, “The insider’s guide to the Philips ARM 7 – based Microcontrollers: An Engineers Introduction to the LPC 2100 Series” Hitex (UK) Ltd., 2005.
3. Muhammed Ali Mazidi, RolinMckinlay and Danny Causey, “PIC Microcontroller and Embedded Systems using Assembly and C for PIC18”, Prentice Hall Publications, 2007.
4. Martin Bates, “Interfacing PIC Microcontrollers-Embedded Design by interactive simulation”, Newnes Publication, 2006.
5. Tim Wilmshurst, “Designing Embedded Systems with PIC Microcontrollers – Principles and Applications”, Newnes Publication, 2007.
6. Julio Sanchez Maria P. Canton, “Microcontroller Programming: The microchip PIC”, CRC Press, Taylor & Francis Group, 2007.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓											
2			✓									
3		✓										
4									✓			
5												✓

PTEI7015 MODEL PREDICTIVE CONTROL LT P C
3 0 0 3

COURSE OBJECTIVES

- To teach the students the general principles of model predictive control scheme.
- To provide a comprehensive description of model predictive control schemes namely as dynamic matrix control, generalized predictive control scheme and State space based model predictive control scheme.
- To highlight the key features of MPC for its Industrial Success.
- To introduce the skills required to formulate both unconstrained and constrained optimal control schemes.
- To develop the skills needed to design Model Predictive Control schemes to achieve the desired performance.

UNIT I MODEL PREDICTIVE CONTROL SCHEMES 9

Introduction to Model Predictive Control - Model Predictive Control Elements - Model Predictive Control Schemes: Dynamic Matrix Control and Model Algorithmic Control – Case Studies

UNIT II GENERALIZED PREDICTIVE CONTROL SCHEME 9

Generalized Predictive Control Scheme – Simple Implementation of Generalized Predictive Control Scheme for Industrial Processes – Multivariable Generalized Predictive Control Scheme – Case Studies

UNIT III STATE SPACE BASED MODEL PREDICTIVE CONTROL SCHEME 9

State Space Model Based Predictive Control Scheme - Review of Kalman Update based filters – State Observer Based Model Predictive Control Schemes – Case Studies

UNIT IV CONSTRAINED MODEL PREDICTIVE CONTROL SCHEME 9

Constraints Handling: Amplitude Constraints and Rate Constraints – Constraints and Optimization – Constrained Model Predictive Control Scheme – Case Studies.

UNIT V ADVANCED TOPICS IN MPC 9

Robust Model Predictive Control Scheme – Adaptive Model Predictive Control Scheme – Multiple-Model based Model Predictive Control Scheme - Fast Methods for Implementing Nonlinear Model Predictive Control Scheme – Case Studies

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Ability to explain the advantages and disadvantages of various MPC schemes.
2. Ability to design both unconstrained and constrained model predictive controllers.
3. Ability to explain the advanced Features supported by the MPC Scheme.
4. Ability to Identify, formulate and solve problem in the field of Process Control domain using MPC.
5. Ability to implement MPC algorithms in MATLAB/SCILAB.

TEXT BOOKS:

1 Camacho, E.F., and Bordons, C., "Model Predictive Control", 2nd Edition, Advanced in Industrial Control Springer Verlag, 2013.

2 Liuping Wang, "Model Predictive Control System Design and Implementation Using MATLAB", Advanced in Industrial Control, Springer Verlag, 2009.

REFERENCES:

1 Wayne Bequette, B., "Process Control: Modeling, Design, and Simulation", Prentice Hall of India, 2004.

2 Seborg,D.E., Duncan, A. Mellichamp , Edgar,T.F., and Doyle,F.J., III, "Process Dynamics and Control", John Wiley and Sons, 3rd Edition, 2010.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1					✓							
2	✓		✓	✓	✓			✓				
3					✓							
4	✓		✓	✓	✓			✓				
5					✓	✓						

PTEI7016 NON-LINEAR CONTROL SYSTEMS LT P C
3 0 0 3

COURSE OBJECTIVES :

- To understand the nature of non-linear systems and to analyze the stability of such systems
- To develop suitable models of non-linear systems and to develop suitable controllers for such systems
- To understand the chaotic and bifurcation behavior of non-linear systems
- To linearize the non-linear systems.

UNIT I NON-LINEAR SYSTEMS 9

Types of Non-Linearity – Typical Examples – Properties of nonlinear systems – Nonlinear differential equations – Numerical solutions to nonlinear differential equations – Equilibrium points – free and forced responses – Input and output multiplicities.

UNIT II STABILITY OF NON-LINEAR SYSTEMS 9

BIBO and Asymptotic stability – Phase plane analysis (analytical and graphical methods) – Lyapunov Stability Criteria – Krasovskil's method – Variable Gradient Method – Stability Analysis by Describing function method.

UNIT III MODELLING AND CONTROL OF NON-LINEAR SYSTEMS 9

Models for Nonlinear systems - Hammerstein and Wiener models - Input signal design for Identification – On-line parameter estimation for nonlinear systems – Nonlinear PID controller - Gain scheduling control – case studies

UNIT IV CHAOS AND BIFURCATION BEHAVIOR 9

Introduction to Chaos - The Lorenz Equations – Test for chaos - Bifurcation Behavior of ordinary differential equations - Types of Bifurcations - Limit Cycle Behavior and Hopf Bifurcation.

UNIT V LINEARIZATION 9

Methods of linearization – Taylor's series expansion – Jacobean method - state model for systems – Role of Eigen values and Eigenvectors – State transition matrix and its properties – Controllability and observability – Stabilizability and Detectability

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs) :

1. Ability to apply mathematical knowledge and basics of science and engineering to develop model for non-linear system.
2. Ability to analyze non-linear system based on the first principle model.
3. Ability to come out the solution for complex non-linear system.
4. Ability to develop various control schemes for non-linear systems.
5. Ability to linearize non-linear system for developing linear control,

TEXT BOOKS:

1. Hangos, K.M., Bokor, J., and Szederkrnyi, G., "Analysis and control of Non-linear Process systems".

2. Gopal, M., "Digital Control and State Variable Methods: Conventional and Intelligent Control Systems", Fourth Edition, Tata McGraw-Hill, 2012.

REFERENCES:

1. Shankar Sastry, "Nonlinear Systems: Analysis, Stability, and Control", Springer New York, 2013.

2. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2008.

3. Bequette, B.W., "Process Control: Modeling, Design and Simulation", Prentice Hall International series in Physical and Chemical Engineering Sciences, 2003.

4. Steven E. LeBlanc, and Donald R. Coughanowr, "Process Systems Analysis and Control", 3rd Edition, Chemical Engineering series, McGraw-Hill Higher Education, 2009.

5. Thompson, J. M. T., and Stewart, H. B.," Nonlinear Dynamics and Chaos", John Wiley & Sons, 2002.

6. William S. Levine, "The Control Systems Handbook", Second Edition: Control System Advanced Methods, 2nd Edition, CRC Press, 2010.

7. NPTEL Lecture on "Non-linear system Analysis" by Prof. Laxmidhar Behera, IIT Kanpur.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓											
2		✓										
3			✓									
4				✓								
5				✓								

PTEI7017 NUCLEAR POWER PLANT INSTRUMENTATION L T P C

3 0 0 3

COURSE OBJECTIVES

- To introduce students to the fundamentals of nuclear power reactor.
- The construction and principle of operation of the different sensing and indicating devices used at nuclear power plants will be explained to students.
- To study about the various types of Nuclear power Reactor.
- To characterize radioactive wastes based on the analysis of radioactive waste generation.
- To elaborate different types of control schemes involved in nuclear power plant.

UNIT I FUNDAMENTAL CONSIDERATIONS IN NUCLEAR POWER REACTOR 9

Nuclear and Fossil Fuels, Definitions: Nuclear Terms, Fission Process Terms, Nuclear Reactor Terms, Nuclear Reactor Kinetics: Point Kinetics without delayed neutrons – Point Kinetics with delayed neutrons, Reactivity, Inhour equation, Effects of reactivity Insertions, Reactivity changes –Three Dimensional Kinetics.

UNIT II MEASURING INSTRUMENTS AND ANALYZER IN NUCLEAR POWER PLANT 9

Nuclear Radiation Sensors – Out-of-Core – Neutron Sensors – In-Core – Process Instrumentation: Temperature Sensing, Pressure Sensing and transmitting, Flow Sensing, Level and Position Sensing, Steam Properties Sensing, Water Properties Sensing, Gas Properties Sensing – Special sensor for Sodium cooled reactors and gas cooled reactors.

UNIT III TYPES OF NUCLEAR POWER REACTOR 9

Pressurized Water Reactor – Boiling Water Reactor – Pressurized Heavy Water Reactor – Sodium Cooled Fast Reactor – Advanced Gas Cooled Reactor .

UNIT IV NUCLEAR WASTE DISPOSAL AND REACTOR SAFETY 9

Types of Radioactive Wastes : Exempt waste and very low level waste, Low level waste, Intermediate Level waste, High level waste – Treatment and conditioning of Nuclear waste - Waste Disposal Methods, Nuclear Reactor Safety: Introduction, Accident Prevention, Engineered safety features, Abnormal Event Analysis – Licensing design basis Evaluation.

UNIT V MODELING AND CONTROL OF NUCLEAR POWER REACTOR 9

Multipoint Kinetics modeling of Large reactors: Introduction, Derivation of Multipoint Kinetics model, Selection of suitable nodalization scheme, Application to the AHWR Thermal hydraulics model, Coupled Neutronics –Thermal Hydraulics model – Reactor Stability Analysis – Control of Nuclear Power: General features of Reactor control, Methods of control, control loops , Effectiveness of control rods, Output Feedback control design - Direct block diagonalization and composite control of Three time scale systems – Design of Fast output sampling controller for Three time scale systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to recognize and recall the basics of nuclear reactor terminology, definitions, and concepts associated with nuclear reactor physics.
2. Ability to understand the types of radiation measurement equipment and nuclear power plant instrumentation.
3. Ability to identify and analyze the specific features of different types of nuclear reactors.
4. Ability to understand the role and responsibility of effective nuclear waste disposal.
5. Ability to apply their mathematical knowledge and engineering principles to model the nuclear reactor and able to control the reactor.

TEXT BOOKS:

1. Joseph M. Harrer and James G. Beckerly, “Nuclear Power Reactor Instrumentation Systems Handbook”, Office of Information Services, U.S. Atomic Energy Commission, 1973.

2. Samuel Glasstone and Alexander Sessonske, ”Nuclear Reactor Engineering”, CBS publishers and Distributors Pvt. Ltd., 2004.

REFERENCES:

1. Shimjith, S.R., Tawari A.P., and Bandyopathy, B. “Modeling and Control of a Large Nuclear reactor”, BARC Mumbai, India.

2. Yoshiaki Oka and Katsuo Suzuki, “Nuclear Reactor Kinetics and Plant Control”, An Advanced

Course in Nuclear Engineering, Springer Japan.

3. James J. Duderstadt and Louis J. Hamilton, "Nuclear Reactor Analysis" Wiley, 1st Edition, 1976.

4. NPTEL Video Lectures on "Nuclear Reactors and Safety - An Introduction" by Dr. G. Vaidyanathan.

5. NPTEL Video Lectures on "Nuclear Science & Engineering" by Dr. Santanu Ghosh.

6. NPTEL Video Lectures on "Nuclear Reactor Technology" by Dr. K.S. Rajan.

7. NPTEL Video Lectures on "Nuclear Physics: Fundamentals and Applications" by Prof. H.C. Verma

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1												
2		✓				✓						
3												
4						✓						
5	✓											

PTEI7018 POWER ELECTRONICS DRIVES AND CONTROL LT P C
3 0 0 3

COURSE OBJECTIVES

- Comprehensive introduction to various power electronic devices, their structure, operating principle and characteristics
- Give exposure to Various topologies, working principle and analysis of controlled rectifiers and ac controllers
- Detailed knowledge on Classifications, structure, operating principle of dc choppers
- Introduction to different types of Inverters , their principle of operation and waveform control
- Overview on dc and ac drives and their control using power electronic circuits.

UNIT I POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS 9

Operating principle and switching Characteristics : Power diodes - Power BJT, Power MOSFET, IGBT, SCR, TRIAC, GTO,MCT, Power integrated circuits (PIC) – Drive and Protection circuits – Series and parallel operation – Commutation–Simulation tools.

UNIT II CONTROLLED RECTIFIERS AND AC CONTROLLERS 9

Single phase – Three phase – Half controlled – Fully controlled rectifiers – Dual converters -Effect of source and load inductance - AC voltage controllers –Introduction to Cycloconverters, Matrix

converters.

UNIT III DC TO DC CONVERTERS 9

Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators – Buck, Boost, Buck-Boost, and Cuk Regulators.

UNIT IV INVERTERS 9

Voltage source Inverters – Half bridge – Full bridge – Three Phase Bridge Inverters – Voltage control – PWM Techniques – Current Source Inverters: Capacitor Commutated Inverter- Resonant inverters :Series, Parallel, ZVS, ZCS – Introduction to multilevel Inverters.

UNIT V DRIVES AND CONTROL 9

Static and Dynamic equations of dc and ac machines – Electrical breaking – Rectifier and chopper control of DC drives – Principles of v/f control of AC drives – Open loop and Closed loop schemes for DC and AC drives(Block diagram approach only) – Introduction to vector control of AC drives.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to explain various devices and their structure, operating characteristics in the field of electronics.
2. Ability to classify, analyze and design, Control rectifier, chopper and inverter.
3. Will have ability to apply power electronic circuits for the control of popular applications.
4. Exposure to design and analyze PE circuit using simulation software.

TEXT BOOKS:

1. Rashid, M.H., “Power Electronics – Circuits, Devices and Applications”, PHI, 3rd Edition, 2004.
2. Mohan, Udeland and Robbins., “Power Electronics”, John Wiley and Sons, New York, 1995.

REFERENCES:

1. Singh, M.D., and Khanchandani, K.B., “Power Electronics”, 2nd Edition., Tata McGraw-Hill, 2011.
2. Bose, B.K., “Modern Power Electronics and AC Drives”, Pearson Education, 2002.
3. Bimbra, P.S., “Power Electronics”, Khanna Publishers, 2006.
4. Moorthi, V.R., “Power Electronics - Devices, Circuits and Industrial Applications”, Oxford University Press, 2005.
5. NPTEL Lecture Series on “Power Electronics” by Dr.B.G.Fernandes, IIT Bombay.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓											
2		✓										
3				✓								
4					✓							
5												

PTEI7019 ROBOTICS AND AUTOMATION L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

- To study and understand the evolution of robot technology and their classification.
- To introduce the methodology for mathematical representation of different types of robots.
- To acquire knowledge on construction of manipulators and their types.
- To learn the procedure for carrying out kinematics and path learning techniques.
- To expose knowledge on the case studies and design of robot machine interface.

UNIT I BASIC CONCEPTS 9

Brief history -Types of Robot – Technology - Robot classifications and specifications - Design 113 and control issues- Various manipulators – Sensors - work cell - Programming languages

UNIT II DIRECT AND INVERSE KINEMATICS 9

Mathematical representation of Robots - Position and orientation - Homogeneous transformation - Various joints - Representation using the Denavit Hattenberg parameters - Degrees of freedom - Direct kinematics - Inverse kinematics - PUMA 560 & SCARA robotsSolvability - Solution methods- Closed form solution

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9

Linear and angular velocities - Manipulator Jacobian - Prismatic and rotary joints – Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance

UNIT IV PATH PLANNING 9

Definition - Joint space technique - Use of p-degree polynomial - Cubic polynomial - Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation

planning

UNIT V DYNAMICS AND CONTROL 9

Lagrangian mechanics - 2 DOF Manipulator - Lagrange Euler formulation - Dynamic model - Manipulator control problem - Linear control schemes - PID control scheme - Force control of robotic manipulator T

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- understand the evolution of robot technology and mathematically represent different types of robot.
- Get exposed to the case studies and design of robot machine interface.

TEXTBOOKS

1. R. K. Mittal and I. J. Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005
2. John J. Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009 114 REFERENCES

REFERENCE BOOKS

1. Ashitava Ghoshal, Robotics - Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010
2. K. K. Appu Kuttan, Robotics, I K International, 2007
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003
4. R. D. Klafter, T. A. Chimielewski and M. Negin, Robotic Engineering – An Integrated Approach, Prentice Hall of India, New Delhi, 1994
5. M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996
6. B.K. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998

PTEI7020	SAFETY INSTRUMENTED SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To make the students aware of basic concepts of safety instrumented system, standards and risk analysis techniques.
- To make the students understand different layers of protection.
- To make students conscious about safety instrumentation applications.

UNIT I INTRODUCTION 9

Safety Instrumented System (SIS): need, features, components, difference between basic process control system and SIS - Risk: how to measure risk, risk tolerance, Safety integrity level, safety instrumented functions - Standards and Regulation – HSE-PES, AICHE-CCPS, IEC-61508, ANSI/ISA-84.00.01-2004 (IEC 61511 Mod) & ANSI/ISA – 84.01-1996, NFPA 85, API RP 556, API RP 14C, OSHA (29 CFR 1910.119 – Process Safety Management of Highly Hazardous Chemicals – SIS design cycle - Process Control vs Safety Control.

UNIT II PROTECTION LAYERS AND SAFETY REQUIREMENT SPECIFICATIONS 9

Prevention Layers: Process Plant Design, Process Control System, Alarm Systems, Procedures, Shutdown/Interlock/Instrumented Systems (Safety Instrumented Systems – SIS), Physical Protection - Mitigation Layers: Containment Systems, Scrubbers and Flares, Fire and Gas (F&G) Systems, Evacuation Procedures - Safety specification requirements as per standards, causes for deviation from the standards.

UNIT III SAFETY INTEGRITY LEVEL (SIL) 9

Evaluating Risk, Safety Integrity Levels, SIL Determination Method : As Low As Reasonably Practical (ALARP), Risk matrix, Risk Graph, Layers Of Protection Analysis (LOPA) – Issues related to system size and complexity –Issues related to field device safety – Functional Testing.

UNIT IV SYSTEM EVALUATION 9

Failure Modes, Safe/Dangerous Failures, Detected/Undetected Failures, Metrics: Failure Rate, MTBF, and Life, Degree of Modeling Accuracy, Modeling Methods: Reliability Block Diagrams, Fault Trees, Markov Models - Consequence analysis: Characterization of potential events, dispersion, impacts, occupancy considerations, consequence analysis tools - Quantitative layer of protection analysis: multiple initiating events, estimating initiating event frequencies and IPL failure probabilities.

UNIT V CASE STUDY 9

SIS Design check list - Case Description: Furnace/Fired Heater Safety Shutdown System: Scope of Analysis, Define Target SILs, Develop Safety Requirement Specification (SRS), SIS Conceptual Design, Lifecycle Cost Analysis, Verify that the Conceptual Design Meets the SIL, Detailed Design, Installation, Commissioning and Pre-startup Tests, Operation and Maintenance Procedures.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Able to understand the role of safety instrumented system in the industry.
2. Be able to Identify and analyze the hazards.
3. Able to select the safety integrity level for an application.
4. Able to understand the importance of safety environment in industry.

TEXT BOOKS:

1. Paul Gruhn and Harry L. Cheddie," Safety Instrumented systems: Design, Analysis and Justification", ISA, 2nd Edition, 2006.
2. Eric W. Scharpf, Heidi J. Hartmann, Harlod W. Thomas, "Practical SIL target selection: Risk analysis per the IEC 61511 safety Lifecycle", Exida, 2012.

REFERENCES:

1. William M. Goble and Harry Cheddie, "Safety Instrumented Systems Verification: Practical Probabilistic Calculations" ISA, 2005.
2. Edward Marszal, Eric W. Scharpf, "Safety Integrity Level Selection: Systematic Methods Including Layer of Protection Analysis", ISA, 2002.
3. Standard - ANSI/ISA-84.00.01-2004 Part 1 (IEC 61511-1 Mod) "Functional Safety: Safety Instrumented Systems for the Process Industry Sector - Part 1: Framework, Definitions, System, Hardware and Software Requirements", ISA, 2004.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO\PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓	✓	✓	✓								
2	✓	✓	✓	✓								
3			✓	✓	✓	✓	✓					
4			✓	✓	✓	✓	✓					

PTEI7021 UNIT OPERATIONS AND CONTROL L T P C
3 0 0 3

COURSE OBJECTIVES

- Study the unit operations involved for transportation, mixing and separation of solids.
- Study the unit operations involved for transportation, mixing and separation of fluids.
- Understand the basic operations involved with heat exchangers, Distillation and chemical reactions.
- Gain knowledge about the operations of evaporators and crystallizers, drying and cooling towers.
- Gain knowledge on the operation of dryers, distillation column, refrigerators and chemical reactors.

UNIT I MECHANICAL OPERATIONS- I 9

OPERATIONS ON SOLIDS: General Characteristics of solids, Storage and conveying of solids: bunkers, silos, bins and hoppers, transport of solids in bulk, conveyor selection, different types of conveyors. Estimation of particle size - Screening methods and equipment. Adjusting particle size: methods of size reduction, classification of equipment, crushers, grinders. size enlargement- Principle of granulation, briquetting, pelletisation and flocculation. Mixing: mixing of powders. Separation: Electrostatic and magnetic separators, applications.

UNIT II MECHANICAL OPERATIONS-II 9

OPERATIONS ON FLUIDS: Transport of fluids, Mixing and agitation: Mixing of liquids, selection of suitable mixers. Separation: Gravity settling, sedimentation, thickening, double cone classifier, centrifugal separation. Cyclones - Operation, equipment, control and applications.

UNIT III HEAT TRANSFER- I AND ITS APPLICATIONS 9

Heat exchangers: Single pass and multi pass heat exchangers, condensers, reboilers Combustion process in thermal power plant, Distillation: Binary distillation, Batch distillation, controls and operations, Chemical reactors.

UNIT IV HEAT TRANSFER- II 9

Theory of evaporation – single effect and multiple effect evaporators – Crystallization – nucleation and growth – classification of crystallizers. Drying: classification of Dryers, batch and continuous dryers, dryers for solids and slurries and cooling Towers, Refrigeration.

UNIT V CASE STUDY 9

Unit Operations and Control schemes applied to Thermal Power plant, Steel Industry, Paper and Pulp Industry, Leather Industry.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Apply the knowledge on solids & fluids to handle the raw materials.
2. Select and apply relevant handling techniques to convert the solids and fluids for specific applications.
3. Come out with solutions for simple/complex problems in heat transfer and design the heat exchange equipment for different applications such as distillation, boilers.
4. Able to carry out multidisciplinary projects using heat transfer, mass transfer concepts.
5. Gain ability for lifelong learning of new techniques and developments in various types of unit operations in industries.

TEXT BOOKS:

1. Balchen ,J.G., and Mumme, K.J., " Process Control structures and applications", Van Nostrand Reinhold Co., New York, 1988.

2. Warren L. McCabe, Julian C. Smith and Peter Harriot, "Unit Operations of Chemical Engineering", McGraw-Hill International Edition, New York, Sixth Edition, 2001.

3. James R.couper, Roy Penny, W., James R.Fair and Stanley M.Walas, "Chemical Process Equipment :Selection and Design", Gulf Professional Publishing, 2010.

REFERENCES:

1. Waddams, A.L., “Chemicals from petroleum”, Butler and Taner Ltd., UK, 1968.

2. Liptak, B.G., “Process measurement and analysis”, Chilton Book Company, USA, 1995.

3. Luyben W.C., “Process Modeling, Simulation and Control for Chemical Engineers”, McGraw-Hill International edition, USA, 1989.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

CO/PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓											
2					✓							
3			✓									
4									✓			
5												✓

ANNA UNIVERSITY, CHENNAI 600 025
UNIVERSITY DEPARTMENTS
R- 2017
B.E. (PART TIME) ELECTRONICS AND COMMUNICATION ENGINEERING
I – VII SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTPH7102	Physics for Electronics and Information Science	3	0	0	3
3.	PTCY7151	Engineering Chemistry	3	0	0	3
4.	PTEC7101	Circuit Theory	3	0	0	3
5.	PTEC7102	Electronic Devices	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7252	Transform and Partial Differential Equations	3	0	0	3
2.	PTEC7201	Digital Electronics and System Design	3	0	0	3
3.	PTEC7202	Electronic Circuits – I	3	0	0	3
4.	PTEC7203	Signals and Systems	3	0	0	3
PRACTICAL						
5.	PTEC7211	Digital and Electronic Circuit Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEC7301	Communication Theory	3	0	0	3
2.	PTEC7302	Electromagnetic Fields and Waves	3	0	0	3
3.	PTEC7303	Electronic Circuits – II	3	0	0	3
4.	PTEC7304	Operational Amplifiers and Analog Integrated Circuits	3	0	0	3
PRACTICAL						
5.	PTEC7311	Discrete and Integrated Circuits Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEC7401	Digital Communication Techniques	3	0	0	3
2.	PTEC7402	Discrete Time Signal Processing	3	0	0	3
3.	PTEC7403	Microprocessors and Microcontrollers	3	0	0	3
4.	PTEC7404	Transmission Lines and Wave Guides	3	0	0	3
PRACTICAL						
5.	PTEC7411	Communication Systems Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEC7501	Antennas and Wave Propagation	3	0	0	3
2.	PTEC7502	VLSI Design	3	0	0	3
3.	PTEC7503	Wireless Communication	3	0	0	3
4.		Elective I	3	0	0	3
PRACTICAL						
5.	PTEC7511	VLSI Design Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER VI

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTGE7153	Environmental Science and Engineering	3	0	0	3
2.	PTEC7601	Optical Communication	3	0	0	3
3.		Elective II	3	0	0	3
4.		Elective III	3	0	0	3
PRACTICAL						
5.	PTEC7611	High Frequency Communication Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMG7751	Principles of Management	3	0	0	3
2.		Elective – IV	3	0	0	3
3.		Elective – V	3	0	0	3
PRACTICALS						
4.	PTEC7711	Project Work	0	0	9	6
		TOTAL	**9**	**0**	**9**	**15**

ELECTIVES

Sl.No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTEC7001	Adhoc and Wireless Sensor Networks	3	0	0	3
2.	PTEC7002	Advanced Digital Signal Processing	3	0	0	3
3.	PTEC7003	Advanced Wireless Communication	3	0	0	3
4.	PTEC7006	Cognitive Radio Communication	3	0	0	3
5.	PTEC7004	CAD for VLSI	3	0	0	3
6.	PTEC7005	CMOS Analog IC Design	3	0	0	3
7.	PTEC7007	Communication Networks	3	0	0	3
8.	PTEC7008	Control Systems Engineering	3	0	0	3
9.	PTEC7009	Cryptography and Network Security				
10.	PTEC7010	Digital Switching and Transmission	3	0	0	3
11.	PTGE7071	Disaster Management	3	0	0	3
12.	PTEC7011	Electro Magnetic Interference and Compatibility	3	0	0	3
13.	PTGE7072	Engineering Ethics and Human Values	3	0	0	3
14.	PTCS7001	Foundation Skills in Integrated Product Development	3	0	0	3
15.	PTEC7012	Foundations for Nano-Electronics	3	0	0	3
16.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
17.	PTGE7073	Human Rights	3	0	0	3
18.	PTEC7013	Information Theory	3	0	0	3
19.	PTEC7014	Introduction to Web Technology	3	0	0	3
20.	PTGE7075	Intellectual Property Rights	3	0	0	3
21.	PTEC7015	Measurements and Instrumentation	3	0	0	3
22.	PTEC7016	Medical Electronics	3	0	0	3
23.	PTEC7017	Multimedia Compression and Networks	3	0	0	3
24.	PTCS7071	Operating Systems	3	0	0	3
25.	PTEC7018	Parallel and Distributed processing	3	0	0	3
26.	PTEC7019	Principles of Digital Image Processing	3	0	0	3

27.	PTEC7022	Real-time and Embedded Systems	3	0	0	3
28.	PTEC7020	RF and Microwave Communication	3	0	0	3
29.	PTEC7021	RF Microelectronics	3	0	0	3
30.	PTEC7023	Robotics	3	0	0	3
31.	PTEC7024	Satellite Communication	3	0	0	3
32.	PTEC7025	Soft Computing and Applications	3	0	0	3
33.	PTEC7026	Speech Processing	3	0	0	3
34.	PTGE7074	Total Quality Management	3	0	0	3
35.	PTEC7027	VLSI Signal Processing	3	0	0	3
36.	PTEC7028	Wireless Communication Networks	3	0	0	3

PTMA7151 **APPLIED MATHEMATICS** **L T P C**

(Common to all branches of B.E / B.Tech (PT) Programmes) **3 0 0 3**

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES **9**

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION **9**

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **9**

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9**

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUT COMES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTPH7102	PHYSICS FOR ELECTRONICS AND INFORMATION SCIENCE	L T P C 3 0 0 3

(Common to ECE & IT Branches**)**

OBJECTIVE:

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic and optical properties of materials and Nano-electronic devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - Quantum free electron theory – Particle in a finite potential well – Tunneling- Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole.

UNIT II SEMICONDUCTORS AND TRANSPORT PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.

UNIT III MAGNETIC PROPERTIES OF MATERIALS 9

Magnetisation of matter: Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification : diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction- saturation magnetization and curie temperature – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses-– Magnetic principle in computer data storage – Magnetic tapes – Magnetic hard disc (GMR sensor) - Magnetic recording materials .

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – Absorption emission and scattering of light in metals, insulators & Semiconductors - LED's – Organic LED's – Plasma light emitting devices – LCD's – Laser diodes – Optical data storage techniques (including DVD, Blue -ray disc, Holographic data storage).

UNIT V NANO DEVICES 9

Electron density in a conductor – Significance between Fermi energy and volume of the material – Quantum confinement – Quantum structures – Density of states in lower dimensions – Band gap of nanomaterials –Tunneling – Single electron phenomena – Single electron Transistor. Conductivity of metallic nanowires – Ballistic transport – Quantum resistance and conductance – Carbon nanotubes: Properties and applications - Transport of spin – Spintronic devices and applications.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students will able to

- understand the electrical, magnetic and optical properties of semiconductor materials.
- understand the concepts and applications of semiconductor devices.

TEXT BOOKS:

1. Balasubramaniam R. "Callister's Materials Science and Engineering", Wiley-India 2014.
2. Donald Askeland, "Materials Science and Engineering", Cengage Learning India Pvt Ltd., 2010.
3. Kasap S.O., "Principles of Electronic Materials and Devices", Tata Mc Graw-Hill 2007.
4. Pierret R.F., "Semiconductor Device Fundamentals", Pearson 2006.

REFERENCES:

1. Garcia N. and Damask A., "Physics for Computer Science Students", Springer-Verlag, 2012.
2. Datta S., "Quantum Transport: Atom to Transistor", Cambridge University Press 2013.
3. Hanson G.W., "Fundamentals of Nanoelectronics", Pearson Education 2009.
4. Charles Kittel, "Introduction to Solid State Physics", Wiley Publications 2012.
5. Wilson J. and Hawkes, J.F.B., "Optoelectronics: An introduction", Prentice Hall 1989.
6. Neil Gershenfeld, "The Physics of Information Technology", Cambridge Series on Information & the Natural Sciences, Cambridge University Press 2000.

PTCY7151	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRYAND CATALYSIS 9

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions- Types of isotherms – Frendlich adsorption isotherm, Langmuir adsorption isotherm. Industrial applications of adsorption. Catalysis: Characteristics and types of catalysts-homogeneous and heterogeneous, auto catalysis. Enzyme catalysis -factors affecting enzyme catalysis, Michaelis - Menton equation. Industrial applications of catalysts.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry-Grotthuss - Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes-internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-Vis and IR spectroscopy-principles, instrumentation (Block diagram) and applications.

UNIT IV CHEMICAL THERMODYNAMICS 9

Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANOCHEMISTRY 9

Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Preparation of nanoparticles – sol-gel and solvothermal.Preparation of carbon nanotube by chemical vapour deposition and laser ablation.Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning. Properties and uses of nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

TOTAL: 45 PERIODS

OUTCOMES:

- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXT BOOKS:

1. Jain P. C. & Monica Jain., "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2014.
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014

REFERENCES:
1. Pahari A., Chauhan B., “Engineering Chemistry”, Firewall Media, New Delhi, 2012.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. Ashima Srivastava. Janhavi N N, Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi., 2010.
4. Vairam S., Kalyani P., Suba Ramesh., “Engineering Chemistry”, Wiley India Pvt Ltd., New Delhi., 2011.

PTEC7101 CIRCUIT THEORY L T P C

2 2 0 3

OBJECTIVES:

- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

UNIT I DC CIRCUIT ANALYSIS 6+6

Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff’s Current Law, Kirchoff’s voltage law, The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.

UNIT II NETWORK THEOREM AND DUALITY 4+4

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Duals, Dual circuits.

UNIT III SINUSOIDAL STEADY STATE ANALYSIS 8+8

Sinusoidal Steady – State analysis , Characteristics of Sinusoids, The Complex Forcing Function, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance, Nodal and Mesh Analysis, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power.

UNIT IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS 6+6

Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.

UNIT V COUPLED CIRCUITS AND TOPOLOGY 6+6

Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time
- Design and understand and evaluate the AC and DC circuits.

TEXT BOOKS:

1. William H.Kayt, Jr.Jack E. Kemmerly, Steven M.Durbin, “Engineering Circuit Analysis”, Sixth Edition, Tata Mc Graw-Hill Edition, 2012.
2. David A Bell, “Electric Circuits”, PHI,2006

REFERENCES:

1. Charles K. Alexander & Mathew N.O.Sadiku, Fundamentals of Electric Circuits”, Second Edition, Mc Graw- Hill 2003.
2. D.R.Cunningham, J.A.Stuller, “Basic Circuit Analysis”, Jaico Publishing House, 2005

PTEC7102 ELECTRONIC DEVICES L T P C
3 0 0 3

OBJECTIVES:

- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices.

UNIT I PN DIODE and BIPOLAR JUNCTION TRANSISTOR 9

PN junction diode, current equations, V-I characteristics, the bipolar transistor action, minority carrier, distribution, low frequency common base, current gain, non-ideal effects, equivalent circuits, Ebers Moll Model-Gummel Poon-model, Hybrid-pi model, frequency limitations, large signal switching characteristics, SiGe and hetro-junction- bipolar junction transistor.

UNIT II FUNDAMENTALS OF FIELD EFFECT TRANSISTORS 9

Fundamentals of JFETs and their device characteristics, Two terminal MOS structures, threshold voltage and charge distribution, capacitance-voltage characteristics, MOSFET structures, I-V relationships, transconductance and substrate effects, frequency limitations, non-ideal effects, MOSFET scaling, threshold voltage modification due to short and narrow channel effects, avalanche breakdown, drain induced barrier effects.

UNIT III POWER DEVICES AND DISPLAY DEVICES 9

SCR, Diac, Triac, Power BJT, Power MOSFET, IGBT Heat sinks and junction temperature, LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

Metal-Semiconductor Junction-MESFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode-Gallium Arsenide device, LASER diode, UJT, LDR.

UNIT V SEMICONDUCTOR PROCESSING 9

Semiconductor materials, Silicon crystal growth and refining, Doping techniques, Ion implantation, Doping impurity diffusion, Gas-phase diffusion, Oxidation, Chemical vapor deposition (CVD), Silicon deposition and epitaxy, Dielectric layer deposition, Photolithography Etching, Metallization, Metal deposition, Metal silicides, CMOS process, bipolar process

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to:

- Explain the V-I characteristic of diode, UJT and SCR
- Describe the equivalence circuits of transistors
- Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

TEXT BOOKS:

1. Donald A Neaman, "Semiconductor Physics and Devices", Third Edition, Tata Mc Graw Hill Inc. 2007.
2. Streetman and Banerjee, "Semiconductor Physics and Devices", 6th Edition, Pearson Prentice Hall 2006.

REFERENCES:

1. J. P. Colinge, C. A. Colinge, "Physics of semiconductor devices", kluwer academic \ publishers, 2012.
2. Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 2007.
3. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Pearson Prentice Hall, 10thedition, 2008

PTMA7252 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
(Common to Civil, ECE, Mech, Textile, Chemical) 3 0 0 3

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9

Fourier integral theorem – Fourier transform pair - Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange's linear equation – Solution of homogenous linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two dimensional heat equation.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9

Z- Transform – Elementary properties – Inverse Z- transform – Convolution theorem – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL : 45 PERIODS

OUT COMES :

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes.
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
2. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
3. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
4. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTEC7201 DIGITAL ELECTRONICS AND SYSTEM DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce Boolean algebra and its applications in digital systems
- To introduce the design of various combinational digital circuits using logic gates
- To bring out the analysis and design procedures for synchronous and asynchronous Sequential circuits
- To introduce the electronic circuits involved in the making of logic gates
- To introduce semiconductor memories and related technology

UNIT I BASIC CONCEPTS AND COMBINATIONAL CIRCUITS 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map and Tabulation methods.

UNIT II MSI CIRCUITS 9

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry lookahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Case study: Digital transreciver / 8 bit Arithmetic and logic unit

UNIT III SYNCRONOUS SEQUENTIAL CIRCUITS 9

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. Model Development: Designing of rolling display/real time clock

UNIT III ASYNHRONOUS SEQUENTIAL CIRCUITS 9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES 9

Logic families- TTL, MOS, CMOS, BiCMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic design using standard ICs, ROM, PLA and PAL

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Use Boolean algebra and apply it to digital systems.
- Design various combinational digital circuits using logic gates.
- Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.
- Use electronic circuits involved in the design of logic gates.
- Ability to use the semiconductor memories and related technology.

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, “Digital Design”, 5th Edition, Pearson, 2013.
2. Charles H. Roth, Jr, “Fundamentals of Logic Design”, Fourth edition, Jaico Books, 2002.

REFERENCES:

1. William I. Fletcher, “An Engineering Approach to Digital Design”, Prentice- Hall of India, 1980.
2. Floyd T.L., “Digital Fundamentals”, Charles E. Merril publishing company,1982.
3. John. F. Wakerly, “Digital Design principles and practices”, Pearson Education, Fourth Edition, 2007.

PTEC7202 ELECTRONIC CIRCUITS – I L T P C
2 2 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To learn about biasing of BJT and MOSFET circuits
- To design amplifiers
- To study the effect of source and load
- To design amplifiers with active loads
- To study high frequency response of amplifiers

UNIT I BIASING OF DISCRETE BJT AND MOSFET 6+6

DC Load line, operating point, Various biasing methods for BJT-Design-Stability-Bias compensation, Thermal stability, DC bias analysis of MOSFET circuits.

UNIT II BJT AMPLIFIERS 6+6

Small signal Analysis of Common Emitter-AC Loadline, Voltage swing limitations, Common collector and common base amplifiers – Differential amplifiers- CMRR- Darlington Amplifier- Bootstrap technique - Multi stage amplifiers - Cascode Amplifier.

UNIT III MOSFET AMPLIFIERS 6+6

Small signal Analysis of amplifiers, Common source amplifier, Voltage swing limitations, Small signal analysis of Source follower and Common Gate amplifiers, Cascode amplifiers, Differential amplifiers, BiMOS Cascode amplifier.

UNIT IV FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS 6+6

Low frequency analysis, Miller effect, High frequency analysis of CE and MOSFET CS amplifier, Short circuit current gain, cut off frequency – fα fβ, Unity Gain Bandwidth, Determination of bandwidth e of cascode, differential amplifier and multistage amplifiers.

UNIT V IC MOSFET AMPLIFIERS 6+6

IC biasing Current steering circuits for IC amplifiers- current mirrors, - current sources- PMOS and NMOS current sources, Cascode current source, Widlar current source and Bias independent current source. Amplifier with resistive load - Depletion load, current source load and active load, Differential amplifiers and Common Mode Feedback circuits.

TOTAL: 30L + 30T: 60 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

  At the end of the course the students will be able to
- Choose appropriate biasing circuit for BJT and MOSFET amplifiers.
- Design and analyze amplifiers.
- Determine the effect of source and load.
- Design amplifiers with active loads meant for ICs.
- Exposed to high frequency response of BJT and MOSFET amplifiers.
- Design biasing circuits for IC amplifiers.

TEXT BOOKS:

1. Donald .A. Neamen, Electronic Circuit Analysis and Design –3rd edition, Tata McGraw Hill, 2010.
2. Adel .S. Sedra, Kenneth C. Smith, Micro Electronic circuits, 7th Edition, Oxford University Press, 2014.

REFERENCES:

1. David A. —Bell Electronic Devices and Circuits, Oxford Higher Education press,5th Edition,2010
2. Behzad Razavi, — Design of Analog CMOS Integrated Circuits‖, Tata Mc Graw Hill, 2007.
3. Paul Gray, Hurst, Lewis, Meyer —Analysis and Design of Analog Integrated Circuits‖, 4th Edition, John Willey & Sons 2005
4. Millman .J. and Halkias C.C, —Integrated Electronics‖, McGraw Hill, 2001.
5. D.Schilling and C.Belove, —Electronic Circuits‖, 3rd edition, McGraw Hill, 1989

PTEC7203 SIGNALS AND SYSTEMS L T P C

2 2 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce visualization and mathematical representation of continuous-time and discrete-time signals
- To teach the applications of Laplace and Fourier transforms in the analysis of continuous-time signals
- To teach the applications of Z- and Fourier transforms in the analysis of discrete – time signals

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 6+6

Continuous time signals (CT signals)- Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential - classification of CT and DT signals – periodic and a periodic signals, random signals, Energy & Power signals - CT systems and DT systems, Classification of systems.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 6+6

Fourier series analysis- Spectrum of Continuous Time (CT) signals- Fourier and Laplace transforms in Signal Analysis.

UNIT III LINEAR TIME INVARIANT –CONTINUOUS TIME SYSTEMS 6+6

Differential Equation-Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in Analysis.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 6+6

Baseband Sampling of CT signals- Aliasing, Reconstruction of CT signal from DT signal DTFT and properties, Z-transform & properties.

UNIT V LINEAR TIME INVARIANT –DISCRETE TIME SYSTEMS 6+6

Difference Equations-Block diagram representation-Impulse response-Convolution sum-DTFT and Z Transform analysis of Recursive & Non-Recursive systems.

TOTAL: 30L + 30T: 60 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- To compute the spectrum of any signal
- To identify the requirements and use transforms for processing real-world signals
- To analyse and design continuous-time and discrete-time systems

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, Indian Reprint, 2007.
2. B. P. Lathi, “Principles of Linear Systems and Signals”, Oxford, Second Edition, 2009.

REFERENCES:

1. H P Hsu, “Signals and Systems”, Schaum’s Outlines, Tata McGraw Hill,2006
2. S. Haykin and B. Van Veen, "Signals and Systems", Second Edition, Wiley, 2003.
3. P.Ramakrishna Rao, “Signals and Systems” , Tata Mc Graw Hill Publications, 2008.
4. Edward W. Kamen, Bonnie S. Heck, “Fundamentals of Signals and Systems Using the Web and MATLAB”, Pearson, Indian Reprint, 2007
5. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007
6. M.J.Roberts, “Signals & Systems, Analysis using Transform methods & MATLAB”, Tata McGraw Hill (India), 2007.

PTEC7211 DIGITAL AND ELECTRONIC CIRCUIT LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To learn hardware implementation and testing of analog and digital circuits
- To design amplifier circuits to meet desired specifications
- To understand the functionality of combinational and sequential circuits
- To simulate basic combinational and sequential circuits using Hardware Description Language HDL

1. Implementation of Boolean expression using universal gates, BCD adder and 2-bit Magnitude comparator
2. Implementation of Boolean expression using MUX and truth table verification of RS, JK, T, and D Flip Flops
3. BCD counter and counters with seven segment display
4. Data transfer using shift registers
5. Realization of Digital circuits using HDL – Combinational circuits
6. Realization of Digital circuits using HDL – Sequential circuits
7. Frequency Response of CE, CB amplifiers and its Spice simulation
8. Design of CC Amplifier for a specific output impedance and its Spice Simulation
9. Spice simulation of CS, CG, and CD configuration of MOSFET amplifiers with various active load configurations.
10. Design of Differential Amplifiers and its CMRR measurement
11. Frequency response of cascode amplifier
12. Frequency response of cascade amplifier

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to design, build and test any digital logic and analog circuits for handling real life projects.
- Exposed to circuit simulations using present meter technology MOSFETs.
- Exposed to digital IC circuit simulators using HDL.

PTEC7301 COMMUNICATION THEORY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the concepts of various modulations and their spectral analysis
- To introduce random processes and their characteristics
- To understand noise impact on modulations and
- To introduce some of the essential baseband signal processing techniques

UNIT I AMPLITUDE MODULATION 9

Review of Fourier and Hilbert Transforms-Amplitude Modulation – AM, DSBSC, SSBSC, VSB– Spectral analysis of modulated signals–Demodulation – Square law, envelope detectors Superheterodyne receivers

UNIT II ANGLE MODULATION 9

Angle modulation – PM and FM – Narrow band, Wideband FM - Spectral analysis of modulated signal – FM Modulators and FM Demodulators – Discriminator, PLL, Stereo FM

UNIT III RANDOM PROCESS 9

Random variables, Central limit Theorem, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random signal Through a LTI filter.

UNIT IV NOISE PERFORMANCE 9

Noise sources and types – Noise figure and noise temperature – Noise in cascaded systems – Narrow band noise – PSD of in-phase and quadrature noise – Noise performance in AM systems – Noise performance in FM systems – Pre-emphasis and de-emphasis – Capture effect, threshold effect.

UNIT V BASEBAND TECHNIQUES 9

Quantization – Uniform and non-uniform quantization – Quantization noise – Companding laws of speech signals – PCM, DPCM, ADPCM, DM, ADM, and Subband Coding. Multiplexing– TDM (E and T lines), FDM

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Students will have acquired the knowledge on different modulation techniques
- Students will get information about signals broadcasted with different modulation techniques
- Students will understand the role of random process in communication systems.

TEXT BOOKS:

1. S.Haykin, “Communication Systems” 4th edition, John Wiley 2007
2. D.Roody, J.Coolen, “Electronic Communications”, 4th edition PHI 2006

REFERENCES:

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems" – Pearson Education 2006.
2. H P Hsu, Schaum Outline Series- "Analog and Digital Communications" TMH 2006
3. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.
4. B.Sklar, "Digital Communications Fundamentals and Applications" 2nd Edition Pearson Education 2007

PTEC7302 ELECTROMAGNETIC FIELDS AND WAVES L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To impart knowledge on the basics of static electric and magnetic field and the associated laws.
- To give insight into the propagation of EM waves and also to introduce the methods in computational electromagnetics.

UNIT I STATIC ELECTRIC FIELD 9

Introduction to co-ordinate systems , Gradient , Divergence , Curl , Divergence theorem, Stokes theorem , Coulombs law , Electric field intensity , Principle of superposition , Electric scalar potential, Electric flux density. Gauss's law and its application, Permittivity, Polarization, Boundary relation, Capacitance, Dielectric strength ,Energy and Energy density, Poisson and Laplace equation and their application, Numerical examples

UNIT II STATIC MAGNETIC FIELD 9

Magnetic field of a current carrying element ,Amperes law , The Biot – Savart law , Magnetic flux Density and Field intensity , Gauss law for magnetic fields , Torque, Magnetic moment ,Magneto motive force , Permeability , Vector potential , Field computation. Inductance, Energy in an Inductor and Energy density, Boundary relation, Hysterisis, Reluctance and Permeance. Numerical examples

UNIT III TIME VARYING ELECTRIC AND MAGNETIC FIELDS 9

Faradays law , Transformer and Mutual induction , Maxwell's equation , Self and Mutual inductance ,Displacement current , Amperes law and its inconsistency for time varying fields , Boundary relation , Poynting vector , Numerical examples.

UNIT IV PLANE EM WAVES IN ISOTROPIC MEDIA 9

Wave equation from Maxwell's Equation, Uniform plane waves in perfect dielectric, conductors, free space. Polarization, Reflection and Refraction of plane waves at different boundaries, Surface impedance, Numerical examples

UNIT V APPLICATION OF STATIC FIELDS AND COMPUTATIONAL METHODS 9

Deflection of a charged particle, CRO, Ink Jet Printer, Electro static generator, Magnetic Separator, Cyclotron, Velocity selector and Mass Spectrometer, Electromagnetic pump, Introduction to field computation methods-FDM, FEM, MOM, Numerical examples.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- At the end of the course the students will be able to
- Have knowledge on the basics of static electric and magnetic field and the associated laws.
- Understand the propagation of EM waves and also get introduced to the methods in computational electromagnetics.

TEXT BOOKS:

1. W.H.Hayt and A.Buck,‖Engineering Electro Magnetics‖ , 8th Edition, Mc Graw Hill, 2011
2. David .K.Cheng, —Field and wave Electromagnetics ‖, 2nd revised edition, Pearson education, 2013.

REFERENCES:

1. Nannapaneni Narayana Rao,‖ Elements of Engineering Electro Magnetics, 6th edition, Prentice Hall of India, 2007.
2. Mathew.N.O.Sadiku,‖Elements of Electromagnetics‖, Sixth edition ,Oxford University Press, 2015.
3. Karl E.Longman and Sava V.Savov, Fundamentals of Electro-Magnetics, 2nd edition, Prentice Hall of India, 2010.
4. Kraus, Fleisch, —Electromagnetics with Applications, 5th edition, McGraw-Hill, 2010.
5. Guru & Hiziroglu, Electromagnetic Field Theory Fundamentals`` Second edition Cambridge University press, 2009.
6. Ashutosh Pramanik, Electro Magnetism‖ ,Prentice Hall of India,2nd edition, 2008.

PTEC7303 ELECTRONIC CIRCUITS - II L T P C
2 2 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study about feedback amplifiers and oscillator principles
- To design Op Amps
- To design oscillators
- To study about tuned amplifiers
- To know the principles of DC-DC convertors

UNIT I FEEDBACK AMPLIFIERS AND STABILITY 6+6

Basic feedback concepts – Properties of Negative feedback – Four feedback topologies– Analysis of series–shunt, series-series, shunt-shunt and shunt-series feedback amplifiers – stability problem – Gain and Phase-margins- Frequency compensation.

UNIT II OPERATIONAL AMPLIFIER 6+6

Design of two stage operational amplifier, Compensation of Op Amps, Cascode Op Amps, Folded Cascode Op Amps, Telescopic Opamp.

UNIT III OSCILLATORS 6+6

Barkhausen criteria for oscillator – Analysis of RC oscillators – Phase shift and Wein bridge oscillators – LC oscillators – Colpitts, Hartley, Clapp, and Ring Oscillators

UNIT IV TUNED AMPLIFIERS 6+6

Basic principles – Inductor losses – Use of transformers – Single tuned amplifier frequency analysis - Amplifier with multiple tuned circuits – Cascade – Synchronous tuning – Stagger tuning – Stability of tuned amplifiers using Neutralization techniques

UNIT V POWER AMPLIFIERS AND DC CONVERTERS 6+6

Power amplifiers- class A-Class B-ClassAB-Class C-Power MOSFET-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

TOTAL: 30L + 30T: 60 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

  At the end of the course the students will
- Acquire knowledge about feedback amplifiers and oscillator principles.
- Design and Construct oscillators, tuned amplifiers, Multivibrators and DC-DC convertors.

TEXT BOOKS:

1. Adel .S. Sedra, Kenneth C. Smith, Micro Electronic circuits, 7th Edition, Oxford University Press, 2014.
2. Behzad Razavi, — Design of Analog CMOS Integrated Circuits, Tata McGraw Hill, 2007.

REFERENCES

1. Donald .A. Neamen, Electronic Circuit Analysis and Design –3rd edition, Tata McGraw Hill, 2010
2. **NPTEL Course**: http://www.nptel.ac.in/course.php
3. F. Bogart Jr. Electronic Devices and Circuits 6th Edition, Pearson Education, 2007.
4. Muhammad H.Rashid power electronics Pearson Education / PHI , 2004.

PTEC7304 OPERATIONAL AMPLIFIERS AND ANALOG INTEGRATED CIRCUITS L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the circuit configuration of linear integrated circuits.
- To introduce practical applications of linear integrated circuits.
- To introduce the concept of analog multiplier and Phase Locked Loop with applications.
- To study the application of ADC and DAC in real time systems.
- To introduce special function ICs and its construction.

UNIT I CIRCUIT CONFIGURATION FOR LINEAR ICS 9

Current sources, Analysis of difference amplifiers with active loads, supply and temperature independent biasing, Band gap references, Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate. interpretation of TL082 datasheet.

UNIT II APPLICATION OF OPERATIONAL AMPLIFIERS 9

Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Noninverting Amplifiers, Differentiator, Integrator, Voltage to Currency converter, Instrumentation amplifier, Sine wave Oscillators, Low pass and band pass filters, Comparator, Multivibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analysis of four quadrants and variable Transconductance multipliers, Analog multiplier MPY634 features, Voltage controlled oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators, AVC using op-AMP, Frequency synthesizers, Compander ICs.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS 9

Analog switches, High speed sample and hold circuit and IC's, Types of D/A converter, Current driven DAC, Switches for DAC, A/D converter - Flash, Single slope, Dual slope, Successive approximation, DM and ADM, Voltage to Time and Voltage to Frequency converters.

UNIT V SPECIAL FUNCTION ICS 9

Timers, Voltage regulators - linear and switched mode types, Switched capacitor filter, SMPS,features of TPS40200, TPS40210 buck and boost controller, Frequency to Voltage converters, Tuned amplifiers, Power amplifiers and Isolation Amplifiers, Video amplifiers, Fiber optics ICs and Opto couplers, Sources for Noises, Op Amp noise analysis and Low noise OP-Amps.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Ability to design new analog linear circuits
- Ability to analyze and develope linear IC based Systems.
- Ability do select appropriate Ics and circuit for analog system design.

TEXT BOOK:

1. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Mc Graw Hill Education, 2014.

REFERENCES:

1. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits ", Wiley International, 2009.
2. Michael Jacob J., "Applications and Design with Analog Integrated Circuits ", Prentice Hall of Inida,1996.
3. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2012.
4. Botkar K.R., "Integrated Circuits ", Khanna Publishers, 1996.
5. Taub and Schilling, "Digital Integrated Electronics ", Mc Graw Hill, 1977.
6. Coughlin and Driscoll, "Operational amplifiers and Linear Integrated Circuits ", Prentice Hall, 1989.
7. Millman J. and Halkias C., "Integrated Electronics ", Mc Graw Hill, 2001.

PTEC7311 DISCRETE AND INTEGRATED CIRCUITS LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study circuits using feedback concepts and tuned circuits
- To learn circuits using OPAMP,PLL and Timer ICs
- To know the design of power amplifier circuits to meet desired specifications

1. Design and Analysis of Feedback amplifiers
2. Design and analysis of Hartley and Colpitts LC Oscillators
3. Design and analysis of single Tuned amplifier
4. Design and analysis of Wien bridge oscillator using OPAMP
5. Design and analysis of Schmitt trigger using OPAMP
6. Design and analysis of Waveform generators using OPAMP
7. Design and analysis of Active filters using OPAMP
8. Design and analysis of Voltage controlled oscillator using PLL IC
9. Design and analysis of Astable and Monostable Multivibrators using Timer IC

TOTAL : 30 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Ability to design oscillators and multistage amplifiers
- Ability to analyse power amplifier circuits.
- Ability to design circuits using OPAMP,PLL and Timer ICs

PTEC7401 DIGITAL COMMUNICATION AND TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To demonstrate the concept of information and types of channels
- To understand the various source coding theorems and the fundamental limit of transmission over the channel.
- To understand the various baseband and bandpass processing techniques.
- To understand spread spectrum.

UNIT I BASEBAND TECHINIQUES 9

Overall picture and the relevance of digital communication techniques, Pulse Modulation-PAM,PPM and PDM, Line codes – RZ,NRZ, Manchester, Binary N-zero substitution codes- PSDs – ISI – Nyquist criterion for distortionless transmission – Pulse shaping – Correlative coding- M-ary schemes – Eye pattern

UNIT II ERROR CONTROL CODING TECHNIQUES 9

Channel coding theorem – Linear block codes – Hamming codes – Cyclic codes – Convolutional codes – Viterbi decoding

UNIT III INTRODUCTION AND INFORMATION THEORY 9

Measure of information – Entropy – Source coding theorem – Discrete memoryless channels– lossless, deterministic, noiseless, BEC, BSC – Mutual information – Channel capacity – Shannon-Hartley law- Transform coding – LPC – Shannon-Fano coding, Huffman Coding, Run length coding, LZW algorithm

UNIT IV BANDPASS SIGNALING 9

Comparison of base band and band pass signaling, Geometric representation of signals – ML detection - Correlator and matched filter detection- generation and detection of BPSK, BFSK, QPSK-BER and Power spectral Density Comparison- Structure of non-coherent receivers- generation and detection of BFSK, DPSK – Principles of QAM – Introduction to Band Pass Sampling theorem.

UNIT V SYNCHRONISATION AND SPREAD SPECTRUM TECHNIQUES 9

Importance of Sync hronisation – Carrier, frame and symbol/Chip synchronisation techniques, Spread Spectrum - PN Sequences, Direct Sequence and Frequency Hopping Spread Spectrum Systems, BER Analysis, Processing gain and Jamming Margin, Spread spectrum in Cellular Systems.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Capable of configuring Source coding schemes
- To be able to design Channel coding schemes
- To be able to design base band signaling scheme analyze their performance
- To be able to design various Bandpass signaling schemes and compare their performance
- Capable of designing synchronization schemes
- Capable of designing spread spectrum systems

TEXT BOOKS:

1. S. Haykin, “Digital Communications”, John Wiley, 2015
2. J.G Proakis, “Digital Communication”, 5/e, Tata Mc Graw Hill Company, 2008.

REFERENCES:

1. B. Sklar, “Digital Communication Fundamentals and Applications”, 2nd edition, Pearson Education, 2009
2. H P Hsu, Schaum Outline Series- “Analog and Digital Communications”, TMH 2006
3. B.P.Lathi, “Modern digital and Analog Communication Systems” 3rd edition, Oxford University Press 2007

PTEC7402 DISCRETE TIME SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To understand computation of spectrum and to analyze systems
- To understand filters for spectrum shaping
- To understand implementation issues in a Digital Signal Processor

UNIT I DISCRETE FOURIER TRANSFORM 9

Review of discrete-time signals & systems - DFT and its properties, FFT algorithms & its applications, Overlap-add & overlap-save methods.

UNIT II DESIGN OF INFINITE IMPULSE RESPONSE FILTERS 9

Analog filters – Butterworth filters, Chebyshev Type I filters (upto 3 rd order), Analog Transformation of prototype LPF to BPF /BSF/ HPF. Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear Z transform method - Realization structures for IIR filters – direct, cascade, parallel forms.

UNIT III DESIGN OF FINITE IMPULSE RESPONSE FILTERS 9

Design of linear phase FIR filters windowing and Frequency sampling methods - Realization structures for FIR filters – Transversal and Linear phase structures, Comparison of FIR & IIR.

UNIT IV FINITE WORDLENGTH FFECTS 9

Representation of numbers-ADC Quantization noise-Coefficient Quantization error, Product Quantization error-truncation & rounding errors -Limit cycle due to product round-off error- Round- off noise power

UNIT V INTRODUCTION TO DIGITAL SIGNAL PROCESSORS 9

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Design systems using spectrum information
- Hardware design and implementation of digital signal processing systems

TEXT BOOKS:

1. John G Proakis and Manolakis, —Digital Signal Processing Principles, Algorithms and Applicationsll, Pearson, Fourth Edition, 2007
2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8 th Indian Reprint, Pearson, 2004.

REFERENCES:

1. Steven W. Smith, “Digital Signal Processing – A practical guide for Engineers and Scientist”, Newnes publications, 2003
2. I.C.Ifeachor and B.W. Jervis, Digital Signal Processing- A practical approach, Pearson, 2002.
3. D.J. De Fatta, J.G.Lucas and W.S. Hodgkiss, Digital Signal Processing- A system Design Approach, John Wiley & sons, Singapore, 1988.
4. M. H. Hayes, Digital Signal Processing, Schaum‘s outlines, Tata McGraw Hill, 2007.
5. Sanjit K. Mitra, Digital Signal Processing: A Computer-Based Approach, 4th Edition, Copyright© 2011, The McGraw-Hill Companies, Inc

PTEC7403 MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the architecture of 8085, 8086 and 8051
- To study the addressing modes and instruction set of 8085, 8086 and 8051
- To introduce the need and use of interrupt structure in 8085 and 8051.
- To develop skill in simple program writing for 8085 and 8051 applications.
- To introduce commonly used peripheral / interfacing ICs.

UNIT I 8- BIT MICROPROCESSOR. 9

8085 Architecture, Pin configuration, Instruction set, Addressing modes, Interrupts, Timing diagrams Memory and I/O interfacing.

UNIT II 16- BIT MICROPROCESSOR. 9

8086 Architecture, Instruction set, Addressing modes, Minimum and Maximum mode configuration, Assembler Directives, Assembly Language Programming, Interrupts. Features of 80186, 80286, 80386, and 80486.

UNIT III PERIPHERALS AND INTERFACING 9

Programmable Peripheral Interface (8255), Keyboard display controller (8279), ADC0808 and DAC0808 Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251).

UNIT IV MICROCONTROLLER 9

8051 – Architecture, Special Function Registers (SFRs), Instruction set, Addressing modes, Assembly language programming, I/O Ports, Timers / counters, Interrupts and serial communication.

UNIT V MICROCONTROLLER BASED SYSTEM DESIGN. 9

Interfacing to: matrix display, (16x2) LCD, high power devices, optical motorshaft encoder, Stepper Motor, DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Ability to design and develop microprocessor architecture.
- Ability to develop microprocessor and microcontroller systems for entertainment, communication and medical applications.
- Ability to troubleshoot microprocessor and microcontroller systems.

TEXT BOOKS:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Sixth edition, Penram International Publishing 2012.
2. Douglas V. Hall, "Microprocessor and Interfacing, Programming and Hardware". Revised second Edition 2006, eleventh reprint 2010.Tata McGraw Hill.

REFERENCES:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems", Second Edition, Pearson Education 2008. Fifth impression 2011
2. Krishna Kant, “Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096, PHI, 2007, Seventh Reprint, 2011.
3. Kenneth J. Ayala., “The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, 2012.
4. A.K. Ray, K.M. Bhurchandi, “Advanced Microprocessor and Peripherals”, Second edition, Tata McGraw-Hill, 2010.
5. Barry B. Brey, “The Intel Microprocessors Architecture, Programming and Interfacing”, Pearson Education, 2007. Second impression 2010.

PTEC7404 TRANSMISSION LINES AND WAVE GUIDES L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the various types of transmission lines and to discuss the losses associated.
- To provide thorough understanding about impedance transformation and matching.
- To give insight about the usage of smith chart in problem solving is dealt with.
- To import knowledge on filter theories and waveguide theories are imparted.

UNIT I TRANSMISSION LINE THEORY & PARAMETERS 8

Introduction to different types of transmission lines , Transmission line Equation – Solution – Characteristic impedance-Infinite line concept - Distortion less line – loading – input impedance, Losses in Transmission lines– Reflection loss, Insertion loss, return loss, Introduction to planar transmission lines. Numerical examples

UNIT II IMPEDENCE MATCHING AND TRANSFORMATION 9

Reflection Phenomena – Standing waves – λ/8, λ/4 & λ/2 lines – λ/4 Impedance transformers, Stub Matching – Single and Double Stub – Smith Chart and Applications. Numerical examples

UNIT III NETWORK COMPONENTS 8

Filter fundamentals, Filter design- lumped element and distributed element approach to filter design – Design of Attenuators and Equalizers – Lattice type , Concept of inverse networks–Transients in transmission lines, Lattice diagram. Numerical examples

UNIT IV RECTANGULAR WAVE GUIDES 10

Waves between Parallel Planes – characteristic of TE , TM and TEM waves , Velocities of propagation ,Solution of wave Equation in Rectangular guides ,TE and TM modes , Dominant Mode, Attenuation, Mode Excitation, Dielectric slab wave guides, Numerical examples.

UNIT V CYLINDRICAL WAVE GUIDES 10

Solution of wave equation in circular guides, TE and TM wave in circular guides, Wave impedance, attenuation, mode excitation, formation of cylindrical cavity, Application , cavity resonator and Q for dominant mode, Numerical examples. Practical examples of transmission line and waveguides in communication.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

  At the end of the course the students will be able to
- Analyze the various types of transmission lines and to discuss the losses associated.
- Understand impedance transformation and matching.
- Use smith chart in problem solving
- Apply knowledge on filter theories and waveguide theories are imparted.

TEXT BOOK:

1. John D Ryder —Networks lines and fields‖ Prentice Hall of India, 2005

REFERENCES:

1. E.C.Jordan and K.G. Balmain, —Electromagnetic Waves and Radiating Systems‖ Prentice Hall of India, 2011.
2. Bhag Singh Guru & Hüseyin R. Hiziroglu,"Electromagnetic Field Theory Fundamentals, Second edition Cambridge University press, 2005
3. R. K. Shevgaonkar, " ELECTROMAGNETIC WAVES, Tata Mc Graw Hill Publications, 2006
4. G.S.N Raju "Electromagnetic Field Theory and Transmission Lines‖ Pearson Education India, First edition 2005.

PTEC7411 COMMUNICATION SYSTEMS LABORATORY L T P C

0 0 3 2

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- It is intended to demonstrate the architecture of analog and digital communication link components to the students
- Students must understand the role of each module present in the communication links
- They have to study by evaluating the comparing the performance of each techniques used in various modules.

1. AM / FM Modulator and Demodulator
2. Time Division Multiplexing
3. Signal Sampling and reconstruction
4. Pulse Code Modulation and Demodulation
5. Delta Modulation and Demodulation
6. Line coding schemes
7. FSK, PSK and DPSK schemes (Simulation)
8. Error control coding schemes (Simulation)
9. Symbol Timing Synchronization
10. Equalization – Zero Forcing & LMS algorithms
11. Spread spectrum communication (Simulation)
12. Communication link simulation

TOTAL: 30 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Ability to experimentally analyze the performance of various kinds of signaling used in communication systems and their bandwidth requirement.
- They gets hands on experience on system construction and performance evaluation
- Ability to study issues from communication links and channels, and their equalization techniques

PTEC7501 ANTENNAS AND WAVE PROPAGATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To give insight into the radiation phenomena.
- To give a thorough understanding of the radiation characteristics of different types of antennas
- To create awareness about the the different types of propagation of radio waves at different frequencies

UNIT I FUNDAMENTALS OF RADIATION 9

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

UNIT II APERTURE AND SLOT ANTENNAS 9

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas, Microstrip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis

UNIT III ANTENNA ARRAYS 9

N element linear array, Pattern multiplication, Broadside and End fire array – Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array

UNIT IV SPECIAL ANTENNAS 9

Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR, Practical antennas for mobile handset and base station applications.

UNIT V PROPAGATION OF RADIO WAVES 9

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept ,Sky wave propagation – Virtual height, critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

  At the end of the course the students will be able to
- Have insight into the radiation phenomena
- Have a thorough understanding of the radiation characteristics of different types of Antennas.
- Identify the different types of propagation of radio waves at various frequencies.

TEXT BOOKS:

1. John D Kraus,‖ Antennas for all applications‖, 3rd Edition, Mc Graw Hill, 2005
2. R.E.Collin, Antennas and radiowave propagation Mc graw hill 1985

REFERENCES:

1. Constantine.A.Balanis, Antenna Theory Analysis and Design‖ Wiley student edition,3rd edition,2009.
2. Edward C.Jordan and Keith G.Balmain Electromagnetic Waves and Radiating Systems‖ Prentice Hall of India, 2006.
3. Rajeswari Chatterjee: Antenna Theory and Practice ‖Revised Second edition ‖New Age international Publishers, 2011.
4. S.Drabowitch, Modern Antennas‖ Second edition, Springer Publications, 2007.
5. Robert S.Elliott, Antenna theory and Design ‖Wiley student edition, 2010.
6. H.Sizun, Radio Wave Propagation for Telecommunication Applications ‖ First Indian Reprint, Springer Publications, 2007.

PTEC7502 VLSI DESIGN L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To learn the fundamentals of VLSI design
- To understand the IC Manufacturing Process
- To familiarize with VLSI combinational logic circuits design
- To familiarize with VLSI sequential logic circuits design
- To learn the various arithmetic circuits and testing methodologies
- To familiarize with the different FPGA architectures

UNIT I MOS TRANSISTOR PRINCIPLES 9

MOS Technology and VLSI, Pass transistors, NMOS, CMOS Fabrication process and Electrical properties of CMOS circuits and Device modelling. Characteristics of CMOS inverter, Scaling principles and fundamental limits. Propagation Delays, CMOS inverter scaling, Stick diagram, Layout diagrams, Elmore's constant, Logical Effort. Case study: Study of technology development in MOS

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Static CMOS logic Design, Design techniques to improve the speed, power dissipation of CMOS logic, low power circuit techniques, Ratioed logic .Pass transistor Logic, Transmission CPL, DCVSL, Dynamic CMOS logic, Domino logic, Dual Rail logic, NP CMOS logic and NOR array logic.

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static and Dynamic Latches and Registers, Timing Issues, Pipelines, Clocking strategies, Memory Architectures, and Memory control circuits.

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS & TESTING 9

Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Need for testing- Manufacturing test principles- Design for testability. Case study: Analysis of area, power and delay for 16 bit adder and 8 bit multilpier

UNIT V IMPLEMENTATION STRATEGIES 9

Full Custom and Semicustom Design, Standard Cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures. Demo: Complete ASIC flow using Backend tool and fabrication flow Overall case study: Development of IC in commercial aspects (design, testing and fab cost)

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- At the end of the course students will be in a position to understand the basics of VLSI design, testing and different FPGA architectures.

TEXT BOOK:

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, “Digital Integrated circuits: A design perspective”. Second Edition, Prentice Hall of India, 2003.

REFERENCES

1. N.Weste, K.Eshraghian, “Principles of CMOS VLSI DESIGN”, A system Perspective, second edition, Addision Wesley 2004
2. A.Pucknell, Kamran Eshraghian, “BASIC VLSI DESIGN”, Third edition, Prentice Hall of India, 2007.
3. M.J. Smith, “Application specific integrated circuits”, Addisson Wesley, 1997
4. R.Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, 2005 Prentice Hall of India

PTEC7503 WIRELESS COMMUNICATION L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To illustrate the behavior of the wireless channel and its impact on system design
- To understand the design aspects of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the relevance of multiple antenna techniques.

UNIT I WIRELESS CHANNELS 9

Large scale path loss – Path loss models: Free Space and Two-Ray models- Link Budget design – Small scale fading - Parameters of mobile multipath channels – Time dispersion parameters- Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading, Practical illustration of Wireless Channel behavior,

UNIT II CELLULAR ARCHITECTURE 9

Introduction to RF Spectrum and its commercial aspects, Multiple Access techniques- FDMA, TDMA, CDMA – Capacity calculations–Cellular concept-Frequency reuse- channel assignment - hand off - interference & system capacity - trunking & grade of service – Coverage and capacity improvement, Relevance to today's communication demands.

UNIT III DIGITAL SIGNALING FOR FADING CHANNELS 9

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR, Technology Examples

UNIT IV MULTIPATH MITIGATION TECHNIQUES 9

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms, Diversity – Micro and Macrodiversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

UNIT V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – spatial multiplexing- System model- Pre-coding- Beam forming - transmitter diversity, receiver diversity - Channel state information-capacity in fading and non-fading channels, Relevance to upcoming wireless communication technologies

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student would be capable of characterizing a wireless channel and evolve the system design specifications
- The student would be capable of designing a cellular system based on resource availability and traffic demands
- The student would be able to identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration
- The student would be capable of exploiting multiple antenna techniques for capacity/ performance gains.

TEXT BOOK:

1. Rappaport,T.S., "Wireless communications", Pearson Education, Second Edition, 2010.

REFERENCES:

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.
3. Upena Dalal, "Wireless Communication", Oxford University Press, 2009.
4. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.
5. Simon Haykins & Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.
6. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.

PTEC7511 **VLSI DESIGN LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To learn the Hardware Description Language (Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with hardware/software based embedded system.

I FPGA BASED EXPERIMENTS:

1. Design and simulation of Full adder and full subtractor
2. Design and simulation of multiplexer, Decoder and 4 bit comparator
3. Design and simulation of 8 bit adder
4. HDL based design entry and simulation of Ripple counter, synchronous counter and BCD counter
5. Design and simulation of simple state machines
6. 4 bit multiplier design and simulation using HDL
7. Synthesis, P&R and post P&R simulation of the components simulated in (1-6) above. Critical paths and static timing analysis results to be identified. Identify and verify possible conditions under which the blocks will fail to work correctly.
8. Hardware fusing and testing of each of the blocks simulated in (1-6). Use of either chipscope feature (Xilinx) or the signal tap feature (Altera) is a must. Invoke the PLL and demonstrate the use of the PLL module for clock generation in FPGAs.

II IC Design Experiments (Based on Cadence/MAGMA/Tanner)

9. Design and simulation of a simple five transistor differential amplifier – Measure gain, ICMR and CMRR
10. Layout generation, parasitic extraction and resimulation of the five transistor differential amplifier
11. Synthesis and standard cell based design of circuits simulated in 9 above. Identification of critical paths, power consumption
12. For experiment 11 above, P & R, Power and clock routing and post P & R simulation
13. Analysis of results of static timing analysis

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

At the end of the course, the student should be able to

- Write HDL code for basic as well as advanced digital integrated circuits.
- Import the logic modules into FPGA Boards.
- Synthesis, Place and Route the digital IPs.
- Design, simulate and extract the layout of Analog IC Blocks using EDA tools.

PTGE7153 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To the study of nature and the facts about environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, Scope and Importance of Environment – Need for Public Awareness - Concept of an Ecosystem – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the (A) Forest Ecosystem (B) Grassland Ecosystem (C) Desert Ecosystem (D) Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries) – Introduction to Biodiversity Definition: Genetic, Species and Ecosystem Diversity – Bio geographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – Endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of Biodiversity.

Field Study of Common Plants, Insects, Birds

Field Study of Simple Ecosystems – Pond, River, Hill Slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – Causes, Effects and Control Measures of: (A) Air Pollution (B) Water Pollution (C)Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Soil Waste Management: Causes, Effects and Control Measures of Municipal Solid Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – Disaster Management: Floods, Earthquake, Cyclone and Landslides.

Field Study of Local Polluted Site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies - Timber Extraction, Mining, Dams and Their Effects on Forests and Tribal People – Water Resources: Use and Over-Utilization of Surface and Ground Water, Floods, Drought, Conflicts Over Water, Dams-Benefits and Problems – Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies – Food Resources: World Food Problems, Changes Caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies – Energy Resources: Growing Energy Needs, Renewable and Non Renewable Energy Sources, Use of Alternate Energy Sources. Case Studies – Land Resources: Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources – Equitable Use of Resources for Sustainable Lifestyles.

Field Study of Local Area to Document Environmental Assets – River / Forest / Grassland / Hill / Mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From Unsustainable to Sustainable Development – Urban Problems Related to Energy – Water Conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People; its Problems and Concerns, Case Studies – Role of Non-Governmental Organization- Environmental Ethics: Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies. – Wasteland Reclamation – Consumerism and Waste Products – Environment Production Act– Air (Prevention And Control Of Pollution) Act – Water (Prevention And Control Of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Enforcement Machinery Involved in Environmental Legislation- Central and State Pollution Control Boards- Public Awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population Growth, Variation Among Nations – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students will be able to:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:

1. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Second Edition, Pearson Education 2004.
2. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill, 2006.

REFERENCES:

1. R.K. Trivedi, “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T. H. Gorhani, ‘Environmental Encyclopedia’, Jaico Publishing, 2001.
3. Dharmendra S. Sengar, “Environmental law”, Prentice Hall, 2007.
4. Rajagopalan.R, “Environmental Studies-From Crisis to Cure”, Oxford University Press 2005.

PTEC7601 OPTICAL COMMUNICATION L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the principle of light propagation through optical fibers
- To understand signal distortion mechanisms in the fiber
- To introduce optical transmitters and receivers for fiber /free space links
- To introduce optical network concepts and components involved.

UNIT I OPTICAL FIBERS 9

Relevance of optical communication in backhaul/backbone networks and interconnects, fiber optics and free space optics, optical fiber structure and parameters, ray and mode theory of light propagation in optical fibers, fiber materials, fiber fabrication techniques, passive optical components - Optical couplers, filters, isolators.

UNIT II TRANSMISSION CHARACTERISTICS 9

Optical signal attenuation mechanisms in guided and unguided optical signal transmissions, Optical signal distortion – Group delay, material dispersion, waveguide dispersion, polarization mode dispersion, intermodal dispersion, profile dispersion, fiber types, Standard Singlemode Fibers, Dispersion Shifted Fibers, Dispersion Flattened Fibers, Polarization Maintaining Fibers, Photonic Crystal Fibers, Dispersion compensation, Principles of fiber nonlinearities.

UNIT III OPTICAL TRANSMITTERS 9

Materials for optical sources, light-emitting diodes, semiconductor laser diodes, longitudinal modes, gain and index-guiding, power-current characteristics, spectral behaviour, longitudinal mode control and tunability, noise, direct and external modulation, Laser sources and transmitters for free space communication.

UNIT IV OPTICAL RECEIVERS 9

Principles of optical detection, spectral responsivity, PIN, APD, preamplifier types, receiver noises, Signal to Noise Ratio (SNR) and Bit Error Rate (BER), Principles of coherent detection, link power and rise time budget, **relevance of power and rise time budget in practical link/network planning.**

UNIT V OPTICAL NETWORKING PRINCIPLES 9

Optical amplifiers: erbium doped fiber amplifiers, semiconductor optical amplifiers, Optical switches, Optical MEMS components, Networking Concepts: SONET/SDH/FDDI optical networks, WDM optical networks, layered optical network architecture.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Insight about the fibers types characteristics and light propagation.
- Thorough knowledge about fiber optic link transmitter and receiver types and design
- Optical networking concepts with components are explored and compared with conventional ideas.

TEXT BOOKS:

1. Gerd Kaiser, “Optical Fiber Communications”, 5th edition, Tata McGraw Hill, New Delhi, 2013.
2. John M. Senior, ‖Optical Fiber Communications- Principles and Practice‖, Third Edition, 3rd impression, Pearson Education, 2012.

REFERENCES:

1. Gerd Keiser, — Optical communications Essentials‖, Special Indian Edition, Tata Mc Graw Hill, New Delhi,2008.
2. Govind P. Agrawal, — Fiber-Optic Communication Systems‖, Third Edition, John Wiley & Sons, reprint 2012.
3. Rajiv Ramasamy & Kumar N. Sivarajan, —Optical Networks – A Practical Perspective‖, 3rd Edition, Morgan Kauffman 2009.

PTEC7611 HIGH FREQUENCY COMMUNICATION LAB L T P C
0 0 3 2

1. Characterization of Glass and Plastic Optical Fibers – Measurement of Numerical Aperture, Attenuation and Mode characteristics.
2. DC Characteristics of LED and PIN Photodiode. – Determination of External Power Efficiency of LED and Responsivity and Dark current of the PIN photo diode.
3. Laser diode Characteristics - Threshold Current Determination and Study of Temperature Effects. Comparison of LED and LASER diode.
4. APD Characteristics – Determination of Threshold Voltage and Average gain estimation. Comparison of APD and PIN photo diode
5. Analog Transmission Characteristics of a Fiber Optic Link – Determination of Operating Range of LED and System Bandwidth Determination for Glass and Plastic fiber links and determination of device capacitance of photo diode.
6. Determination of Capacity of a Digital Fiber Optic Link – Maximum Bit Rate estimation for Glass and Plastic fiber links
7. Determination of Mode Characteristics of a Reflex Klystron Oscillator
8. VSWR and Inpedance Measurement and Impedance Matching
9. Characterisation of Directional Couplers and Multiport junctions
10. Gunn Diode Characteristics

TOTAL: 30 PERIODS

PTMG7751 PRINCIPLES OF MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To study the Evolution of Management
- To study the functions and principles of management
- To learn the application of the principles in an organization

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management –Science or Art – Manager Vs Entrepreneur- types of managers-managerial roles and skills – Evolution of Management –Scientific, human relations , system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart–organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization –Job Design - Human Resource Management –HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour– motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling –budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would have gained the ability to learn the different principles and techniques of management in planning, organizing, directing and controlling.

TEXT BOOKS:

1. Stephen P. Robbins & Mary Coulter, " Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

PTEC7001 ADHOC AND WIRELESS SENSOR NETWORKS **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To equip the students with knowledge of 4G networks and its applications
- To teach the students about various MAC and Routing protocols of Ad hoc and WSN.
- To educate the students on introduction and application of 6lowpan.

UNIT I INTRODUCTION AND APPLICATIONS **9**

Introduction to Ad hoc Networks, Characteristic features, Need for Ubiquitous Computing network, Applications of Ad hoc ,Mobility Models : - Brownian Model, Column model, Random Walk Model, Random Waypoint model, Random Gauss Markov Model, Reference point Group Mobility Model.

UNIT II ROUTING PROTOCOLS **9**

Need for Different routing Protocols, Proactive Vs Reactive Routing. Unicasting: Dynamic Source Routing, Ad Hoc On-Demand Distance Vector Routing, Temporally Ordered Routing Algorithm, Signal Stability Based Routing, Location Aided Routing, Associativity Based Routing, Zone Routing Protocol. Multicasting: Tree Based Algorithm: CAMP, Mesh based Algorithm: On-Demand Multicast Routing Protocol.

UNIT III OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks-.Single-Node Architecture- Hardware Components, Energy Consumption of Sensor Nodes

UNIT IV NETWORKING OF SENSORS 9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts- S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols - Energy-Efficient Routing, Geographic Routing.

UNIT V INTRODUCTION AND APPLICATION OF 6LOWPAN 9

Introduction - Architecture, Protocol stack - Link layers – Addressing - Header format – Bootstrapping - Mesh topologies - Internet integration, Functions of an Adaptation Layer, Routing -Mesh-Under - Route-Over –ROLL, Common Protocols –WSP, MQTTS, CAP, Operating system – Contiki - µIPv6, case study - Industrial automation - Health care.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student would have gained the knowledge on ad hoc and sensor networks
- The student would have the ability to design new MAC and Routing protocols for Ad hoc and sensor network.
- The students have attained the capability to learn new operating systems used for WSN.

REFERENCES:

1. Charles E. Perkins " Ad hoc Networking", Addison-Wesley, 2000
2. Tracy Camp, Jeff Boleng, Vanessa Davies, " A survey on Mobility Models for Ad hoc Network Research." Wireless Communications and Mobile Computing: Special Issue on Mobile Ad hoc Networking: Research, Trends and Applications, Vol.2. No. 5. pp 483-502,2002.
3. Hongmei Deng, Wei Li and Dharma P. Agrawal " Routing security in wireless ad hoc networks"., IEEE Communication magazine, Oct. 2002.
4. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
5. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2007.
6. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, And Applications", John Wiley, 2015.
7. Zach Shelby, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet" John Wiley & Sons, November 2009, ISBN: 978-0-470-74799-5.

PTEC7002 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To bring out the concepts related to stationary and non-stationary random signals
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction
- To introduce the concept of wavelet transforms in the context of image processing

UNIT I DISCRETE-TIME RANDOM SIGNALS 9

Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, White noise, Power Spectral Density, Spectral Factorization, Innovations Representation and Process, Filtering random processes, ARMA, AR and MA processes.

UNIT II SPECTRUM ESTIMATION 9

Bias and Consistency, Periodogram, Modified periodogram, Blackman-Tukey method, Welch method, Parametric methods of spectral estimation, Levinson-Durbin recursion.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Forward and Backward linear prediction, Filtering - FIR Wiener filter- Filtering and linear prediction, non-causal and causal IIR Wiener filters,.

UNIT IV ADAPTIVE FILTERS 9

Principles of adaptive filter – FIR adaptive filter – Newton's Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT V WAVELET TRANSFORM 9

Short Time Fourier Transform, Multiresolution analysis, Continuous and discrete wavelet transform, Application of wavelet transform.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- To identify appropriate spectrum estimation method based on type of random signal
- To design filters for processing random signal
- To implement multi resolution approach for signals

TEXT BOOKS:

1. Monson H, Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. John G.Proakis, Dimitris G. Manolakis, Digital Signal Processing, Pearson, Fourth 2007.
3. Dwight F. Mix, Random Signal Processing, Prentice Hall, 1995.

REFERENCE:

1. Sophocles J. Orfanidis, Optimum Signal Processing, An Introduction, McGraw Hill, 1990.
2. Ramachandran K. I., Soman K. P. , Resmi N. G. **,** Insight into Wavelets from Theory to practice, Eastern Economy Edition , 2010

PTEC7003 ADVANCED WIRELESS COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To teach the importance of improving capacity of wireless channel using MIMO
- To teach the characteristic of wireless channel
- To teach techniques for channel improvements using space-time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems

UNIT I INTRODUCTION 9

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to the TX – capacity of deterministic channels, Random channels and frequency selective channels.

UNIT II RADIO WAVE PROPAGATION 9

Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods.

UNIT III SPACE TIME BLOCK CODES 9

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

UNIT IV SPACE TIME TRELLIS CODES 9

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

UNIT V LAYERED SPACE TIME CODES 9

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student has gained the knowledge about the importance of MIMO in today's communication
- The student had understood and appreciate the various methods for improving the data rate of wireless communication system.

TEXT BOOKS:

1. Mohinder Jankiraman, Space-time codes and MIMO systems, Artech House, Boston, London . www.artech house.com, ISBN 1-58053-865-7-2004
2. Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.

REFERENCES:

1. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
2. Sergio Verdu “ Multi User Detection” Cambridge University Press, 1998
3. Andre Viterbi “ Principles of Spread Spectrum Techniques” Addison Wesley 1995
4. Volker Kuhn, “Wireless communication over MIMO channels” John Wiley and Sons Ltd.2006.

PTEC7006 COGNITIVE RADIO COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the concept of software defined radios and their architectures
- To introduce the concept of cognitive radio communication and the components involved
- To introduce the cognitive radio architecture and the functions and issues involved in communication system design.

UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO 9

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications.

UNIT II SDR ARCHITECTURE 9

Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNIT III INTRODUCTION TO COGNITIVE RADIOS 9

Marking radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE 9

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS 9

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The students will be able to understand and compare different SDR architectures.
- The students will be able to identify the role of SDR and Cognitive radio communication in XG networks.

TEXT BOOK:

1. Qusay. H. Mahmoud, “Cognitive Networks : Towards Self Aware Network”, John Wiley & Sons Ltd. 2007.

REFERENCES:

1. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, “Software Defined Radio”, John Wiley, 2003.
2. Huseyin Arslan, “Cognitive Radio, SDR and Adaptive System”, Springer, 2007.
3. Joseph Mitola, “Cognitive Radio Architecture”, John Wiley & Sons, 2006.
4. Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, “Cognitive Radio Communication and Networks”, Elsevier, 2010.
5. J. Mitola, “ Cognitive Radio: An Integrated Agent Architecture for software defined radio”, Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.
6. Simon Haykin, “Cognitive Radio: Brain –empowered wireless communications”, IEEE Journal on selected areas in communications, Feb 2005.
7. Hasari Celebi, Huseyin Arslan , “ Enabling location and environment awareness in cognitive radios”, Elsevier Computer Communications , Jan 2008.

PTEC7004 CAD FOR VLSI L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To understand the suite of tools available for support and design of VLSI circuits
- To introduce rules and planning methodologies for synthesizing VLSI circuits
- To introduce different modeling schemes for synthesizing VLSI circuits

UNIT I VLSI DESIGN METHODOLOGIES 9

Introduction to VLSI Design methodologies - Review of Data structures and algorithms – Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methods for combinatorial optimization.

UNIT II DESIGN RULES 9

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms – partitioning.

UNIT III FLOOR PLANNING 9

Floor planning concepts - shape functions and floorplan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

UNIT IV SIMULATION 9

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis.

UNIT V MODELLING AND SYNTHESIS 9

High level Synthesis - Hardware models - Internal representation - Allocation -assignment and scheduling - Simple scheduling algorithm - Assignment problem - High level transformations.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply VLSI design methodologies and design rules for digital circuits.
- Use floor planning concepts for digital circuits.
- Apply Gate level and Switch level modeling and Simulate digital circuits

TEXT BOOK:

1. S.H. Gerez, “Algorithms for VLSI Design Automation”, John Wiley & Sons,2002.

REFERENCE:

1. N.A.Sherwani, “Algorithms for VLSI Physical Design Automation”, Kluwar Academic Publishers, 2002.

PTEC7005 CMOS ANALOG IC DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the DC biasing conditions of various MOS amplifier configurations
- To understand the small signal model of various MOS circuits
- To study the noise modeling and analysis procedure associated with various MOS circuits
- To study OPAMP circuits and its stability conditions
- To study in general negative feedback concept in MOS circuits

UNIT I BASIC BUILDING BLOCKS 9

NMOS and PMOS device operation in saturation and sub-threshold regions, device transconductance, output impedance and equivalent circuit. Introduction to Device models for simulation. CG, CG, and source follower circuits. gm/Id design methodology

UNIT II MULTIPLE TRANSISTOR STAGES 9

Cascode circuits. folded cascode circuits, , Differential amplifier circuits, quantitative analysis of differential pair, CMRR, Differential pair with MOS loads, Gilbert Cell, Current Mirrors.

UNIT III FREQUENCY RESPONSE, NOISE 9

Frequency response of CS and CG stages. Miller effect and association of poles with nodes. Characteristics of noise – thermal and flicker noise. Noise in CS, CG, Cascode and source follower stages.

UNIT IV OPERATIONAL AMPLIFIERS 9

Two stage op-amps, gain boosting, common mode feedback, input range limitation, slew rate, power supply rejection, noise in op-amps.

UNIT V FEEDBACK AND STABILITY 9

Properties of feedback circuits, topologies, effect of loading and noise in feedback circuits. Stability in multipole systems, phase margin, frequency compensation in two stage op-amps, other compensation techniques.

TOTAL: 45 PERIODS

OUTCOMES:

Students who complete this course would be in a position

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- To carry out design of the various building blocks used in CMOS analog ICs. These include current mirror, cascades, common source amplifiers, differential amplifiers, two stage OTAs, source followers.
- To carry out the paper design based on hand calculations for the above important building blocks. This is normally the first mandatory step in the complete design and fabrication of CMOS Analog ICs, and enables the student to carry out circuit simulations and layout design. In conjunction with other similar courses in this area,
- Equip the students with the skills required to pursue design and/or research carriers in the broad field of electronics and communication.

TEXT BOOK:

1. B.Razavi, **"**Design of CMOS Analog Integrated Circuits", Tata McGraw Hill 2002.
2. P.R.Gray, Hurst and Meyer "Analysis and Design of Analog Integrated Circuits", Fifth Edition, John Wiley, 2009
   NPTEL Course: http://nptel.ac.in/courses/117106030/#

REFERENCE:

1. Willy Sansen , **"** Analog Design Essentials:" Springer 2006

PTEC7007 COMMUNICATION NETWORKS L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the layered communication architectures
- To understand various physical, data link and routing layer protocols
- To understand application layer protocols and security issues.
- To understand various digital switching techniques.

UNIT I NETWORK FUNDAMENTALS AND PHYSICAL LAYER 9

Communication Network Evolution and Recent Trends, definition of layers, services, interface and protocols, OSI reference model - layers and duties. TCP/IP reference model – layers and duties. Physical layer - general description, characteristics, signaling media types, topologies, examples physical layer (RS232C, ISDN, ATM, SONET)

UNIT II DATA LINK LAYER AND NETWORK INTERCONNECTION 9

Logical link control Functions: - Framming, Flow control, Error control: CRC, LLC protocols:-HDLC, P to P. Medium access layer: - Random access, Controlled access, Channelization, IEEE standards: - 802.3, 802.4 and 802.5. Internetworking, Interconnection issues, Interconnection devices: - Repeaters, Hubs, Routers/switches and Gateways.

UNIT III MESSAGE ROUTING TECHNOLOGIES 9

Circuit switching, packet switching, message switching. Internet protocols; IPV4, IPV6, ARP, RARP, ICMP, IGMP, VPN. Network Routing Algorithms:- Distance vector routing, OSPF, Dijikstra's , Bellaman Ford, Congestion control algorithms.

UNIT IV END-END PROTOCOLS AND SECURITY 9

Process-process delivery: - TCP, UDP and SCTP. Application protocols: WWW, HTTP, FTP and TELNET, Network management protocol: SNMP, Network security.

UNIT V DIGITAL SWITCHING 9

Switching functions, Space Division Switch, Time Division Switch, STS switching, TST switching, No 4 ESS Toll switch, digital cross connect systems, Recent advances in Switching Approaches, Introduction to Software Defined Networking

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student would be well versed on the layered communication architectures
- The student would have gained an understanding of the need for different protocols at the different layers and their interworking.
- The student will have an exposure to the various digital switching techniques, wnd would be able to appreciate the evolving trends.

TEXT BOOKS:

1. Behrouz.A. Forouzan, Data Communication and Networking, 4th Edition, Tata McGraw Hill, 2007.
2. John C. Bellamy, Digital Telephony, 3rd Edition, John Wiley 2006.

REFERENCES:

1. Stallings.W., Data And Computer Communication, 4th Edition, Prentice Hall of India, 1996
2. Tanenboum, A.S, Computer Netwotks, 3rd Edition , Prentice Hall Of India, 1996
3. Keshav.S. An Engineering Approach To Computer Networking, Addision – Wesley,1999.
4. J.E.Flood, Telecommunication Switching, Traffic and networks, 1st edition, Pearson Education, 2006.

PTEC7008 CONTROL SYSTEMS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems
- To introduce the state variable analysis method.

UNIT I CONTROL SYSTEM MODELING 9

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

UNIT II TIME RESPONSE ANALYSIS 9

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

UNIT IV STABILITY ANALYSIS 9

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability, Analysis using MATLAB

UNIT V STATE VARIABLE ANALYSIS 9

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems. Sampled Data control systems – Sampling Theorem – Sampler & Hold – Open loop & Closed loop sampled data systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Compute the transfer function of different physical systems. (Level – III (Application))
- Analyze the time domain specifications and calculate the steady state error. (Level – IV (Analysis))
- Illustrate the frequency response characteristics of open loop and closed loop system response. (Level – II (Comprehension))
- Analyze the stability using Routh and root locus techniques. (Level – IV (Analysis))
- Illustrate the state space model of a physical system and discuss the concepts of sampled data control system. (Level – II (Comprehension))

TEXT BOOK:

1. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.

REFERENCES:

1. M.Gopal, "Control System – Principles and Design", McGraw-Hill, 2nd edition 2006.
2. Constantine H. Houpis, Stuart N. Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Press, 6th edition 2013.
3. Richard C. Dorf & Robert H. Bishop, "Modern Control Systems", Prentice Hall, 12th edition (2010)
4. Joseph J. DiStefano, Allen R. Stubberud, Schaum's Outline of "Feedback and Control Systems", McGraw-Hill Education; 2nd edition 2013.
5. Farid Golnaraghi, Benjamin C. Kuo, "Automatic Control Systems", Wiley, 9th edition (2009)

PTEC7009 CRYPTOGRAPHY AND NETWORK SECURITY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To teach the importance of security for networks
- To teach the basics of number theory and Galois field concepts
- To teach symmetric and asymmetric key in crypto systems
- To teach authentication and key management techniques
- To teach security specific to network layer

UNIT I NUMBER THEORETIC AND ALGEBRAIC ALGORITHMS 9

Significance of network and data security in todays communication scenario – Overall Classification - Integer Arithmetic Modular Arithmetic – matrices – Linear congruence- Substitution ciphers – Transposition ciphers – Stream cipher- Block ciphers – Algebraic structures – GF(2^n) fields.

UNIT II MODERN SYMMETRIC KEY CIPHERS 9

Modern block ciphers – Modern stream ciphers – DES – AES – uses of modern block ciphers and stream cipher, Application Examples

UNIT III ASYMMETRIC KEY ENCIPHERMENT 9

Mathematics of cryptography – Primality Testing – Factorization – Chinese Remainder Theorem – Quadratic – Exponentiation & Logarithm – RSA, Rabin – Elliptic curve, Application Examples

UNIT IV INTEGRITY AUTHENTICATION AND KEY MANAGEMENT 9

Message integrity – random oracle model – message authentication – SHA-512 – WHIRL POOL- Digital signature schemes Entity anthentication– password – challenge response – zero knowledge – Biometrics – Kerberos – symmetric key management – public key distribution – steganography, Application Examples.

UNIT V NETWORK SECURITY 9

Security at the Application Layer: E-mail – PGP – S/MIME – Security at the transport layer: SSL and TLS – Security at the network layer: IPsec, Two Security Protocol – Security Association – Internet Key Exchange – ISAKMP, Application Examples.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student have gained the knowledge about the importance of security for networks, use of number theory and Galois field concepts.
- The student would have ability to design new symmetric and Asymmetric key crpto system
- The student would have ability to develop new authentication and key management techniques.

TEXT BOOKS:

1. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata McGraw Hill, 2007.
2. W.Stallings, “Cryptography & Network Security: Principles and Practice”, Prentice Hall, Third Edition, 2003.

REFERENCES:

1. Douglas R.Stlinson, “Cryptography Theory and Practice”, CRC Press series on Discrete Mathematics and its application 1995.
2. Charlie Kaufman, Radia Perlman, Mike Speciner, “Network Security Private Communication in a Public World”, Pearson Education, Second Edition, 2003.

PTEC7010 DIGITAL SWITCHING AND TRANSMISSION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce different types of signaling in digital telephony
- To introduce various transmission schemes for telephony and broadband
- To introduce modeling and analysis techniques for data transmission

UNIT I INTRODUCTION 9

Overview of existing Voice, Data and Multimedia Networks and Services; Review of Basic Communication principles; Synchronous and Asynchronous transmission, Line Codes

UNIT II TRUNK TRANSMISSION 9

Multiplexing & Framing - types and standards; Trunk signaling; Optical Transmission-line codes and Muxing: SONET/SDH; ATM; Microwave and Satellite Systems.

UNIT III LOCAL LOOP TRANSMISSION 9

The Analog Local Loop; ISDN local loop; DSL and ADSL; Wireless Local Loop; Fiber in the loop; Mobile and Satellite Phone local loop.

UNIT IV SWITCHING 9

Evolution; Space switching, Time switching and Combination Switching; Blocking and Delay characteristics; Message ,Packet and ATM switching; Advances in switching techniques – shared memory fast packet switches, shared medium fast packet switches and space division fast packet switches, Photonic switching - Optical TDM, WDM.

UNIT V TELETRAFFIC ENGINEERING 9

Telecom Network Modeling; Arrival Process; Network Blocking performance; Delay Networks-Queuing system analysis and delay performance.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student have gained the ability to understand the different type of signaling, transmission schemes and switching techniques used in digital telephony.
- They have gained the ability to model and analyze the different techniques for data transmission**.**

TEXT BOOKS:

1. J. Bellamy, “Digital Telephony”, John Wiley, 2003, 3rd Edition.
2. JE Flood, “Telecommunications Switching, Traffic and Networks”, Pearson, 2005.

REFERENCES:

1. R.A.Thompson, “Telephone switching Systems”, Artech House Publishers, 2000.
2. W. Stalling, “ Data and Computer Communications”, Prentice Hall, 1993.
3. T.N.Saadawi, M.H.Ammar, A.E.Hakeem, “Fundamentals of Telecommunication Networks”, Wiley Interscience, 1994.
4. W.D. Reeve, “Subscriber Loop Signalling and Transmission Hand book”, IEEE Press (Telecomm Handbook Series), 1995.
5. Tarmo Anttalaien, “Introduction to Telecommunication Network Engineering”, 2nd edition, Artech House, 2003.
6. T. Viswanathan, “Telecommunication Switching Systems”, Prentice-Hall, 1992.

PTGE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management

TEXT BOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTEC7011	ELECTRO MAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
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OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To tutor the basics of EMI,EMC
- To instill knowledge on the EMI coupling mechanism and its mitigation techniques
- To impart comprehensive insight about the current EMC standards and about various measurement techniques

UNIT I BASIC CONCEPTS 7

Definition of EMI and EMC; Intra and Inter system EMI; Sources and victims of EMI, Conducted and Radiated EMI emission and susceptibility; Transient & ESD; Case Histories; Radiation Hazards to humans.

UNIT II COUPLING MECHANISM 9

Common made coupling; Differential mode coupling; Common impedance coupling; Ground loop coupling; Field to cable coupling; Cable to cable coupling; Power mains and Power supply coupling.

UNIT III EMI MITIGATION TECHNIQUES 10

Shielding – principle, choice of materials for H, E and free space fields, and thickness; EMI gaskets; Bonding; Grounding – circuits, system and cable grounding; Filtering; Transient EMI control devices and applications; PCB Zoning, Component selection, mounting, trace routing.

UNIT IV STANDARDS AND REGULATION 7

Units of EMI; National and International EMI Standardizing Organizations – IEC, ANSI, FCC, CISPR, BIS, CENELEC; FCC standards; EN Emission and Susceptibility standards and specifications; MIL461E Standards.

UNIT V TEST METHODS AND INSTRUMENTATION 12

EMI test sites - Open area site; TEM cell; Shielded chamber; Shielded Anechoic chamber; EMI test receivers; Spectrum Analyzer; Transient EMI Test wave Simulators; EMI coupling Networks - Line impedance Stabilization Networks; Feed through capacitors; Antennas and factors; Current probes and calibration factor; MIL-STD test methods; Civilian STD Test methods, Government policies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

  Upon Completion of the course, the students will be able to
- To design a EMI free system
- To reduce system level crosstalk
- To design high speed Printed Circuit board with minimum interference
- To make our world free from unwanted electromagnetic environment

TEXT BOOKS:

1. V.P. Kodali, ―Engineering EMC Principles, Measurements and Technologies‖, IEEE Press, New york, 2010 (2nd Edition)
2. Henry W.Ott., ―Noise Reduction Techniques in Electronic Systems‖, A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 2009

REFERENCES:

1. Don R.J.White Consultant Incorporate, ―Handbook of EMI/EMC‖, Vol I-V, 1988 2. Bemhard Keiser, ―Principles of Electromagnetic Compatibility‖, 3rd Ed, Artech house, Norwood, 1987
2. C.R. Paul, ―Introduction to Electromagnetic Compatibility‖, John wiley & sons Inc. 2006

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES L T P C
(Common to all branches) **3 0 0 3**

OBJECTIVES
- To emphasize into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES 3
Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9
Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9
Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime - the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIESON SAFETY 12
Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and Chernobyl as case studies.

UNIT V GLOBAL ISSUES 12
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will have the ability to perform with professionalism , understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000
5. R.Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

PTCS7001 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT **L T P C 3 0 0 3**

OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to **Product Development Methodologies and Management** - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - Traceability Matrix and Analysis - Requirement Management - **System Design & Modeling** - Introduction to System Modeling - System Optimization - System Specification - Subsystem Design - Interface Design

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques **– Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design** - Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping** - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product validation processes and stages - Product Testing standards and Certification - Product Documentation - **Sustenance** - Maintenance and Repair – Enhancements - **Product EoL** - Obsolescence Management - Configuration Management - EoL Disposal

UNIT V BUSINESS DYNAMICS ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product development in Industry versus Academia - **The IPD Essentials** - Introduction to vertical specific product development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and S/W systems – Product development Trade-offs - Intellectual Property Rights and Confidentiality - Security and configuration management.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXT BOOKS:

1. Book specially prepared by NASSCOM as per the MoU
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, New Delhi, 2011
3. John W New Storm and Keith Davis, "Organizational Behavior", Tata Mc Graw Hill, Eleventh Edition, New Delhi, 2005.

REFERENCES:

1. Hiriyappa B, —Corporate Strategy – Managing the Business‖, Authorhouse, USA, 2013
2. Peter F Drucker, —People and Performance‖, Butterworth – Heinemann [Elsevier], Oxford, UK, 2004.
3. Vinod Kumar Garg and Venkitakrishnan N, K, —Enterprise Resource Planning – Concepts and Practice‖, Prentice Hall India, New Delhi, 2003
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, New Delhi, 2013.

PTEC7012 FOUNDATIONS FOR NANO - ELECTRONICS L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- The objectives of the course is to introduce quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems

UNIT I INTRODUCTION TO QUANTUM MECHANICS 9

Particles, waves, probability amplitudes, schrodinger equation, wave packets solutions, operators, expectation values, eigen funtions, piecewise constant potentials.

UNIT II SIMPLE HARMONIC OSCILLATORS AND APPROXIMATIONS 9

SHM Operators, SHM wavepacket solutions, Quantum LC circuit, WKB approximations, variational methods.

UNIT III SYSTEMS WITH TWO AND MANY DEGREES OF FREEDOM 9

Two level systems with static and dynamic coupling, problems in more than one dimensions, electromagnetic field quantization, density of states.

UNIT IV STATISTICAL MECHANICS 9

Basic concepts, microscopic, quantum systems in equilibrium, statistical models applied to metals and semiconductors

UNIT V APPLICATIONS 9

Hydrogen and Helium atoms, electronic states, Atomic force microscope, Nuclear Magnetic Resonance, carbon nanotube properties and applications

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student would have gained the knowledge on quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems

TEXT BOOKS:

1. Hagelstein, Peter L., Stephen D. Senturia, and Terry P. Orlando, "**Introduction to Applied Quantum and Statistical Physics**.", New York, NY: Wiley, 2004.
2. Rainer Waser, "Nanoelectronics and Information Technology", Wiley 2005
3. Michael A. Nielsen and Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 2000.

REFERENCES:

1. Neil Gershenfeld "The Physics of Information Technology", Cambridge University Press, 2000.
2. Adrian Ionesu and Kaustav Banerjee eds. " Emerging Nanoelectronics: Life with and after CMOS" , Vol I, II, and III, Kluwer Academic, 2005.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C

3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES:

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PTGE7073 HUMAN RIGHTS L T P C

3 0 0 3

OBJECTIVES:

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I 9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL: 45 PERIODS

OUTCOMES:

- Engineering students will acquire the basic knowledge of human rights

REFERENCES:

1. Kapoor S.K., —Human Rights under International law and Indian Laws, Central Law Agency, Allahabad, 2014.
2. Chandra U., —Human Rights‖, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PTEC7013 **INFORMATION THEORY** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To teach different types of entropy
- To teach entropy in the context of data compression
- To teach channel capacities over different channels

UNIT I QUANTITATIVE STUDY OF INFORMATION **8**

Basic inequalities, Entropy, Kullback-Leibler distance, Mutual information, Bounds on entropy, Fisher information, Cramer Rao inequality, Second law of thermodynamics , Sufficient statistic, Entropy rates of a Stochastic process .

UNIT II CAPACITY OF NOISELESS CHANNEL **8**

Fundamental theorem for a noiseless channel, Data compression, Kraft inequality, Shannon-Fano codes, Huffman codes, Asymptotic equipartition, Rate distortion theory.

UNIT III CHANNEL CAPACITY **9**

Properties of channel capacity, Jointly typical sequences, Channel Coding Theorem, converse to channel coding theorem, Joint source channel coding theorem

UNIT IV DIFFERENTIAL ENTROPY AND GAUSSIAN CHANNEL 9

AEP for continuous random variables, relationship between continuous and discrete entropy, properties of differential entropy, Gaussian channel definitions, converse to coding theorem for Gaussian channel, channels with colored noise, Gaussian channels with feedback

UNIT V NETWORK INFORMATION THEORY 11

Gaussian multiple user channels, Multiple access channel, Encoding of correlated sources, Broadcast channel, Relay channel, Source coding and rate distortion with side information, General multi-terminal networks.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- This course helps to understand insight of source coding
- Students will understand the limitations of the channel
- It helps to understand the data rate that can be offered by the channel in the presence of AWGN

TEXT BOOK:

1. Thomas Cover, Joy Thomas ,"Elements of Information theory ", Wiley, 2005.

REFERENCE:

1. David Mackay , "Information theory, interference & learning algorithms", Cambridge University Press, I edition, 2002

PTEC7014 INTRODUCTION TO WEB TECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the features of object oriented programming languages using Java
- To design and create user interfaces using Java frames and applets
- To have a basic idea about network programming using Java
- To create simple Web pages and provide client side validation
- To create dynamic web pages using server side scripting

UNIT I JAVA FUNDAMENTALS 9

Java Data types – Class – Object – I / O Streams – File Handling concepts – Threads – Applets – Swing Framework – Reflection

UNIT II JAVA NETWORKING FUNDAMENTALS 9

Overview of Java Networking - TCP - UDP - InetAddress and Ports - Socket Programming - Working with URLs - Internet Protocols simulation - HTTP - SMTP - POP - FTP - Remote Method Invocation - Multithreading Concepts.

UNIT III CLIENT SIDE TECHNOLOGIES 9

XML - Document Type Definition - XML Schema - Document Object Model - Presenting XML - Using XML Parsers: DOM and SAX – JavaScript Fundamentals - Evolution of AJAX - AJAX Framework - Web applications with AJAX - AJAX with PHP - AJAX with Databases

UNIT IV SERVER SIDE TECHNOLOGIES 9

Servlet Overview - Life cycle of a Servlet - Handling HTTP request and response - Using Cookies - Session tracking - Java Server Pages - Anatomy of JSP - Implicit JSP Objects – JDBC - Java Beans - Advantages - Enterprise Java Beans - EJB Architecture - Types of Beans - EJB Transactions

UNIT V APPLICATION DEVELOPMENT ENVIRONMENT 9

Overview of MVC architecture - Java Server Faces: Features - Components - Tags - **Struts:** Working principle of Struts - Building model components - View components - Controller components - Forms with Struts - Presentation tags - Developing Web applications -

Hibernate: Configuration Settings - Mapping persistent classes - Working with persistent objects - Concurrency - Transactions - Caching - Queries for retrieval of objects - **Spring:** Framework - Controllers - Developing simple applications

TOTAL: 45 PERIODS

OUT COMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The students gained the knowledge about Java and basic Web concepts and enable the student to create simple Web based applications.

TEXT BOOK:

1. Deitel, Deitel, Goldberg, “Internet & World Wide Web How To Program”, Third Edition, Pearson Education, 2006.

REFERENCES:

1. Marty Hall and Larry Brown, “Core Servlets And Javaserver Pages”, Second Edition
2. Bryan Basham, Kathy Siegra, Bert Bates, “Head First Servlets and JSP”, Second Edition
3. Uttam K Roy, “Web Technologies”, Oxford University Press, 2011.

PTGE7075 INTELLECTUAL PROPERTY RIGHTS L T P C

3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS:

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES:

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTEC7015 MEASUREMENTS AND INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce principles of various measurement techniques using analog and digital equipments
- To teach Importance of signal generators and analyzers in measurements
- To emphasize the need for data acquisition systems and optical domain measurement techniques

UNIT I SCIENCE OF MEASUREMENT 9

Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards.

UNIT II TRANSDUCERS 9

Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD- Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fibre optic sensors – Smart/intelligent sensors.

UNIT III SIGNAL CONDITIONING AND SIGNAL ANALYZERS 9

DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier – Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers.

UNIT IV DIGITAL INSTRUMENTS 9

Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE 488/GPIB Buses.

UNIT V DATA DISPLAY AND RECORDING SYSTEMS 9

Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology.

TOTAL : 45 PERIODS

OUTCOMES:

- Discuss about the principles of various measurement techniques.
- Analyze the transducers and its impact.
- Explain about the signal conditioning system and signal analyzers.
- Illustrate the digital measurement equipments.
- Emphasize the need for data acquisition, recording and display systems.

TEXT BOOKS:

1. Albert D.Helfrick and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 2007.
2. Ernest o Doebelin and dhanesh N manik, “Measurement systems” ,5th edition ,McGraw-Hill, 2007.

REFERENCE:

1. Albert D.Helfrick and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 2nd Edition, 2008.

PTEC7016 **MEDICAL ELECTRONICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters.
- To study about the various assist devices used in the hospitals.
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG,PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

pH, PO_2, PCO_2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters.

UNIT III ASSIST DEVICES 9

Cardiac pacemakers, DC Defibrillator, Dialyser, Heart lung machine

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill, electrical safety

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to telemedicine.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.

Upon completion of the course, students will be able to:

- Discuss the application of electronics in diagnostic and therapeutic area.
- Measure biochemical and various physiological information.
- Describe the working of units which will help to restore normal functioning

TEXT BOOKS:

1. Leslie Cromwell, “Biomedical instrumentation and measurement”, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster,” Medical Instrumentation Application and Design”, 3rd Edition, Wiley India Edition, 2007

REFERENCES:

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 2003.
2. Joseph J.Carr and John M.Brown, “Introduction to Biomedical equipment Technology”, John Wiley and Sons, New York, 2004.

PTEC7017 MULTIMEDIA COMPRESSION AND NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce probability related study of the characteristics of text, voice, image and video data
- To introduce various compression schemes for text, voice, image and video
- To analyse the compression schemes
- To introduce communication protocols for voice over internet and multimedia networking

UNIT I MULTIMEDIA COMPONENTS 9

Introduction- Multimedia skills- Multimedia components and their characteristics- Text, sound, images, graphics, animation, video, hardware.

UNIT II AUDIO AND VIDEO COMPRESSION 9

Audio compression–DPCM-Adaptive DPCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding – Video compression principles-H.261, H.263, MPEG 1, 2, 4.

UNIT III TEXT AND IMAGE COMPRESSION 9

Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding –source encoding- text compression –static Huffman coding dynamic Huffman coding –arithmetic coding –Lempel Ziv-Welsh Compression-image compression

UNIT IV VoIP TECHNOLOGY 9

Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service – CODEC Methods-VOIP applicability.

UNIT V MULTIMEDIA NETWORKING 9

Multimedia networking- Applications-streamed stored and audio-making – Best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Various components of multimedia have been studied
- Compressions and decompressions of multimedia components are explored
- The adaptation of compression techniques in various state-of-the-art technologies were observed

TEXT BOOKS:

1. Fred Halshall, “Multimedia communication- Applications, Networks, Protocols and Standards”, Pearson education, 2007.
2. Tay Vaughan, “Multideai: Making It Work”, 7/e, TMH, 2007.

REFERENCES:

1. Kurose and W. Ross, “Computer Networking “A Top Down Approach, Pearson education, 3rd ed, 2005. Marcus Goncalves “Voice over IP Networks”, McGraw Hill,
2. KR. Rao,Z S Bojkovic, D A Milovanovic, “Multimedia Communication Systems: Techniques, Standards, and Networks”, Pearson Education 2007
3. R. Steimnetz, K. Nahrstedt, “Multimedia Computing, Communications and Applications”, Pearson Education, First ed, 1995.
4. Ranjan Parekh, “Principles of Multimedia”, TMH, 2006.

PTCS7071 OPERATING SYSTEMS L T P C

3 0 0 3

OBJECTIVE

- To learn the concepts of operating systems.
- To learn about the various issues in operating systems.
- To familiarize with the important mechanisms in operating systems.
  To appreciate the emerging trends in operating systems

UNIT I OPERATING SYSTEMS OVERVIEW 9

Introduction to operating systems – Computer system organization, architecture – Operating system structure, operations – Process, memory, storage management – Protection and security – Distributed systems – Computing Environments – Open-source operating systems – OS services – User operating-system interface – System calls – Types – System programs – OS structure – OS generation – System Boot – Process concept, scheduling – Operations on processes – Cooperating processes – Inter-process communication – Examples – Multithreading models – Thread Libraries – Threading issues – OS examples

UNIT II PROCESS MANAGEMENT 9

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple-processor scheduling – Operating system examples – Algorithm Evaluation – The critical-section problem – Peterson’s solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock

UNIT III STORAGE MANAGEMENT 9

Memory Management – Swapping – Contiguous memory allocation – Paging –Segmentation – Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing**.**

UNIT IV I/O SYSTEMS 9

File concept – Access methods – Directory structure – File-system mounting –Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection

UNIT V CASE STUDY **9**

The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication – Network Structure – Security – Windows 7 – History – Design Principles – System Components – Terminal Services and Fast User – File system – Networking.

TOTAL: 45 PERIODS

OUTCOMES:

On Completion of the course, the students should be able to:

- Articulate the main concepts, key ideas, strengths and limitations of operating systems
- Explain the core issues of operating systems
- Know the usage and strengths of various algorithms of operating systems

TEXT BOOK:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts Essentials", John Wiley & Sons Inc., 2010.

REFERENCES:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
2. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
3. M Dhamdhere, " Operating Systems: A Concept-based Approach", Second Edition, Tata Mc Graw-Hill Education, 2007.
4. William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition, Prentice Hall, 2011.

PTEC7018 PARALLEL AND DISTRIBUTED PROCESSING **L T P C**

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the principles of parallel processing
- To understand the concept of shared memory architecture in multiprocessing
- To study the parallel programming models.

UNIT I PARALLEL ARCHITECTURE **9**

Parallel Computer Models, Program and Network properties, Principles of scalable performance

UNIT II PROCESSORS AND MEMORY HIERARCHY, BUS **9**

Advanced processor Technology, Super scalar and vector processor, Memory hierarchy technology, Virtual Memory Technology, Backplane Bus systems.

UNIT III PIPELINING AND SUPER SCALAR TECHNIQUES **9**

Linear Pipeline, Nonlinear pipeline, Instruction pipeline, Arithmetic pipeline, Superscalar and super pipeline design, Parallel and scalable architectures- Multiprocessor and Multicomputers.

UNIT IV SOFTWARE FOR PARALLEL PROGRAMMING **9**

Parallel programming models, languages, compliers- Parallel Program Development and Environments.

UNIT V DISTRIBUTED SYSTEMS 9

Models, Hardware concepts, communication, synchronization mechanism, case study: MPI and PVM, Distributed file systems.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Use different Processor and memory hierarchy technology.
- Apply various types of Pipelining methodologies.
- Identify models, Languages and compilers for Parallel Programming
- Design distributed systems

TEXT BOOKS:

1. Hwang. K, “Advanced computer Architecture”, Parallelism, scalability, Programmability, Tata McGraw Hill, 1993.
2. Tanenbaum A.S, “Distributed Operating Systems”, Pearson Education Asia, 2002.
3. Dezso Sima, Terence Fountain, Peter Kacsuk, “Advanced Computer Architectures”, Pearson Education, 2007.

REFERENCES:

1. V.Rajaraman and C.Siva Ram Murthy, “Parallel Computers Architecture and Programming”, PHI, 2000.
2. Quinn, M.J., “Designing Efficient Algorithms for Parallel Computers”, McGraw - Hill, 2003.
3. Culler, D.E., “Parallel Computer Architecture”, A Hardware – Software approach, Harcourt Asia Pte. Ltd., 1999.

PTEC7019 PRINCIPLES OF DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the formation of an image and its acquisition
- To introduce the use and application of transforms in image processing
- To study techniques for improving quality of information in spoilt images
- To introduce schemes for compressing images to save storage space

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Vidicon and Digital Camera working principles, - Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II IMAGE ENHANCEMENT 9

Point processing, Histograms, Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION 9

Image Restoration - degradation model, Unconstrained and Constrained restoration, Inverse filtering, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation– Region growing – Region splitting and Merging – Segmentation by morphological watersheds – Hybrid methods

UNIT V IMAGE COMPRESSION 9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- To utilize appropriate preprocessing techniques for manipulation of images
- To design automated techniques for image based applications

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson, Education, Inc., Second Edition, 2004.
2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.

REFERENCES:

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
3. D,E. Dudgeon and RM. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, "Digital Image Processing", John Wiley, New York, 2002.
5. Milan Sonka et al, "Image Processing, Analysis and Machine vision", Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.
6. Alan C. Bovik, "Handbook of image and video processing" Elsevier Academic press, 2005.
7. S.Sridhar, " Digital Image processing" Oxford University press, Edition 2011.

PTEC7022 REAL - TIME AND EMBEDDED SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the architecture and programming of ARM processors.
- To introduce the basic concepts of hard real time multiprocessing.
- To introduce the analytical concepts for effective programming.
- To study about the basics of the buses used for embedded system networking.

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9

Complex systems and microprocessors – Embedded system design process – Formalism for system design– Design example: Model train controller- ARM Processor Fundamentals- Instruction Set and Programming using ARM Processor.

UNIT II COMPUTING PLATFORM 9

CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor – Memory system mechanism – CPU performance – CPU power consumption- CPU buses – Memory devices – I/O devices – Component interfacing- System Level Performance Analysis- Parallelism. Design Example: Data Compressor.

UNIT III PROGRAM DESIGN AND ANALYSIS 9

Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Program Optimization- Analysis and optimization of execution time, power, energy, program size – Program validation and testing- Example: Software Modem.

UNIT IV PROCESS AND OPERATING SYSTEMS 9

Multiple tasks and Multi processes – Processes – Context Switching – Operating Systems –Priority based Scheduling- RMS and EDF - Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes.

UNIT V HARDWARE ACCELERATORS & NETWORKS 9

Multiprocessors- CPUs and Accelerators – Performance Analysis- Distributed Embedded Architecture – Networks for Embedded Systems: - I2C, CAN Bus, Ethernet, Myrinet – Network based design – Internet enabled systems. Design Example: Elevator Controller.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Ability to design and develop ARM processor based systems.
- Ability to develop embedded system for entertainment, communication and medical applications.
- Ability to implement distributed embedded computing platform and proper scheduling of the process.

TEXT BOOKS:

1. Wayne Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Morgan Kaufmann Publisher (An imprint of Elsevier), Second Edition, 2008.
2. Andrew N Sloss, Dominic Symes, Chris Wright, “ARM System Developer’s Guide- Designing and Optimizing System Software”, Elsevier/Morgan Kaufmann Publisher, 2008.

REFERENCES:

1. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2010.
2. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dreamtech press, 2005.
3. Jane. W. S. Liu, “Real-Time systems”, Pearson Education Asia.2011
4. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc-Graw Hill, 2004.
5. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.

PTEC7020 RF AND MICROWAVE COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To inculcate understanding of the basics required for circuit representation of RF networks
- To deal with the issues in the design of microwave amplifier
- To instill knowledge on the properties of various microwave components
- To deal with the microwave generation and microwave measurement techniques

UNIT I TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION 9

Low frequency parameters-impedance, admittance, hybrid and ABCD. High frequency parameters-Formulation of S parameters, properties of S parameters-Reciprocal and lossless networks, transmission matrix, Introduction to component basics, wire, resistor, capacitor and inductor.

UNIT II MICROWAVE TRANSISTOR AMPLIFIER DESIGN AND MATCHING NETWORKS 9

Amplifier power relation, stability considerations, gain considerations, noise figure, impedance matching networks, frequency response, T and Π matching networks, microstripline matching networks.

UNIT III PASSIVE MICROWAVE DEVICES AND CIRCUITS 9

Open, short and matched terminations; coupling probes and loops; power divider; directional coupler; attenuators; phase shifter; circulator; isolator; Impedance matching Devices– Tuning screw, stub and quarter-wave transformers

UNIT IV MICROWAVE GENERATION 9

High frequency effects in Tubes, Two cavity klystron amplifier; Reflex klystron oscillator; TWT amplifier, Backwards wave oscillator; Magnetron oscillator – Theory and applications. Solid state devices: Gunn diode oscillator; BARITT, TRAPATT and IMPATT diode oscillator and amplifier, YIG Devices (Yttrium-Iron Garnet).

UNIT V MICROWAVE MEASUREMENTS 9

Measuring Instruments – VSWR meter, Power meter, Spectrum Analyser, Network Analyser – principles; Measurement of Impedance, frequency, power, VSWR, Q factor, dielectric constant, S-Parameter. Hazards of microwaves, permitted power levels for practical applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Upon completion of the course, students will be able to:
- Explain the active & passive microwave devices & components used in Microwave communication systems.
- Analyze the multi- port RF networks and RF transistor amplifiers.
- Generate Microwave signals and design microwave amplifiers.
- Measure and analyze Microwave signal and parameters.

TEXT BOOKS:

1. Robert E.Colin, ―Foundations for Microwave Engineering‖, 2 edition, Wiley India, 2009.
2. Reinhold Ludwig and Gene Bogadanov, RF Circuit Design, Theory and applications, Pearson Education, Inc., 2012.

REFERENCES:

1. Thomas H.Lee, —Planar Microwave Engineering, Cambridge University Press, 2004
2. M.M.Radmanesh,—RF and Microwave Electronics‖, Pearson Education, Inc., first edition 2005
3. S.Y.Liao, - Microwave Devices and Circuits‖, Pearson Education Limited, third edition2006. D.M.Pozar, - Microwave Engineering, John Wiley & sons, Inc., 4th edition, 2012.
4. Guillermo Gonzalez, Microwave Transistor Amplifiers: Analysis and design -Second edition, prentice hall, 1997.
5. Annapurna Das and Sisir K Das, —Microwave Engineering, Tata McGraw Hill Inc., 2nd edition, 2009.

PTEC7021 RF MICROELECTRONICS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce radio transceiver architectures • To understand the design issues in CMOS LNAs , Mixers, Oscillators, PLLs, Synthesizers and Power Amplifiers.

UNIT I TRANSCEIVER ARCHITECTURES 9

Heterodyne and Homodyne architectures, Discrete and CMOS realization passive components for RF, Impedance Matching, Distortion, IIP3 and Blocking Effects, Noise Figure, Noise matching conditions. Friis Formula for cascaded blocks. .

UNIT II CMOS LNAS AND MIXERS 9

Noise Figure of and impedance matching issues CS, CG and differential LNAs, Passive mixers and conversion loss, Active mixers, Gilbert cells, linearity and Noise Figure of mixers.

UNIT III OSCILLATORS 9

Negative transconductance, nonlinearity and Differential LC tuned oscillators, Ring oscillators and Colpitts oscillator, Quadrature oscillators–Phase noise.

UNIT IV PLLS AND SYNTHESIZERS 9

Phase Detectors, charge pumps and their transfer functions, Synthesizers based on first, second and third order PLLs and stability issues, Introduction to integer and fractional N synthesizers.

UNIT V POWER AMPLIFIERS 9

Class A, B, C, D, E, F and AB power amplifiers, Linearization and impedance matching issues of power amplifiers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

Upon completion of the course, students will be able to

- Understand radio transceiver architectures
- Design and Analyze CMOS LNAs , Mixers, Oscillators, PLLs,
- Synthesizers and Power Amplifiers.

TEXT BOOKS:

1. B. Razavi, —RF Microelectronics‖, Pearson Education, 2nd edition,2012.
2. Thomas Lee, —The Design of CMOS Radio Frequency Integrated Circuits, Cambridge University Press, Second Edition, 2004

PTEC7023 ROBOTICS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the electronics and software aspects in the design of robots
- To bring out the different languages for programming robot
- To specify robot requirements in the industry
- To introduce latest state of the art robots

UNIT I SCOPE OF ROBOTS 4

The scope of industrial Robots - Definition of an industrial robot - Need for industrial robots – Economic and Social Issues- applications.

UNIT II ROBOT COMPONENTS 9

Fundamentals of Robot Technology - Automation and Robotics - Robot anatomy - Work volume - Precision of movement - End effectors - Sensors.

UNIT III ROBOT PROGRAMMING 9

Robot Programming - Methods - interlocks textual languages. Characteristics of Robot level languages, characteristic of task level languages.

UNIT IV ROBOT WORK CELL 9

Robot Cell Design and Control - Remote Center compliance - Safety in Robotics.

UNIT V FUTURE TRENDS 14

Telepresence robot, Autonomous mobile robots, Walker Robots, Solar-ball Robot, Underwater bots, Aerobots, Advanced robotics in Space - Specific features of space robotics systems - long-term technical developments, Next generation robots.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Ability to design and develop robotic based systems.
- Ability to develop system for industrial automation and medical applications.
- Ability to provide automatic solution for replacing humans in life threatening area.

TEXT BOOKS:

1. Barry Leatham - Jones, “Elements of industrial Robotics” Pitman Publishing, 1987.
2. J. M. Selig, "Introductory Robotics", Prentice Hall, 1992.
3. John Iovine, "Robots, Android and Animatronics", Second Edition, McGraw-Hill, 2012.
4. John M. Holland, "Designing Autonomous Mobile Robots-Inside the mind of an Intelligent Machine", Newnes Publication, 2004.
5. Robert J. Schilling, "Fundamentals of Robotics- Analysis and Control", Pearson Education, 2006.

REFERENCES:

1. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, “Industrial Robotics Technology, Programming and Applications “, McGraw Hill Book Company 1986.
2. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., “Robotics Control Sensing, Vision and Intelligence“, McGraw Hill, International Editions, 1987.
3. Bernard Hodges and Paul Hallam, “Industrial Robotics”, British Library Cataloging in Publication 1990.
4. Deb, S.R. Robotics Technology and flexible automation, Tata McGraw Hill, 1994.

PTEC7024 SATELLITE COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To enable the student to understand the necessity for satellite based communication, the essential elements involved and the transmission methodologies.
- To enable the student to understand the different interferences and attenuation mechanisms affecting the satellite link design
- .To expose the student to the advances in satellite based navigation, GPS and the different application scenarios.

UNIT I SATELLITE ORBITS AND TRAJECTORIES 8

Orbital Mechanics—Orbit Equations, Kepler’s Laws, Orbital Period, Orbits and their types, look angle calculation; Satellite Launch.

UNIT II SATELLITE SUBSYSTEM 10

Satellite Subsystems—AOCS, TTC&M, Power, Transponders, Antennas; earth control-Effects of earth-Perturbation, suntransit, moontransit, satellite power design, MTBF. Basic Equations; System Noise and G/T ratio; Uplink, Downlink and Design for a specified C/N ratio, with GEO and LEO examples; Atmospheric and Rain effects on link performance.

UNIT III LINK DESIGN, MODULATION AND ERROR CONTROL 10

Single link design-double link design aspects, PAM, baseband processing, Digital Modulation for satellite links- BPSK,QPSK and QAM; TDM standards for satellite systems; Error control requirements for satellite link—ARQ, Concatenated Codes,Interleaving, Turbo codes.

UNIT IV MULTIPLE ACCESS FOR SATELLITE COMMUNICATIONS 9

FDM-FM-FDMA - TDMA-structure and system design; Onboard Processing systems; DAMA and PAMA; CDMA-system design and capacity.

UNIT V SOME APPLICATIONS 8

Remote sensing, navigation, scientific and military application, VSAT—Network Architecture, Access Control protocols and techniques, VSAT Earth stations; Satellite Mobile Telephony—Global star, DBS/DTH Television, GPS, Weather satellites.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- The student would be able to demonstrate an understanding of the basic principles of satellite orbits, placement and control, satellite link design and the communication system components.
- The student would be able to demonstrate an understanding of the different communication, sensing and navigational applications of satellite and their implementation.

TEXT BOOKS:

1. T.Pratt, C. Bostian and J.Allnutt; "Satellite Communications", John Wiley and Sons, Second Edition., 2014.
2. D.Rody, "Satellite Communications", 4th Edition, McGraw Hill, 2006.

REFERENCES:

1. W.L.Pritchard, H G Suyderhoud and R A Nelson, "Satellite Communication System Engineering", Second edition, Prentice Hall, 1993.
2. Tri. T. Ha, "Digital Satellite Communications", McGraw Hill, Second Edition, 1990.
3. B.N.Agarwal, "Design of Geosynchronous Space craft", Prentice Hall, 1986.
4. M. Richharia, "Satellite Systems for Personal Applications", John Wiley, 2010.

PTEC7025	SOFT COMPUTING AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- This course gives an idea and principles of various soft computing techniques, which are applicable to core areas such as networks , pattern recognition, image processing
- To introduce fuzzy set theory
- To teach different optimization techniques
- To introduce neural networks and neuro-fuzzy modeling
- To teach various applications of computational intelligence

UNIT I FUZZY SET THEORY 10

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT II OPTIMIZATION 8

Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT III NEURAL NETWORKS 10

Supervised Learning Neural Networks – Perceptrons - Adaline – Backpropagation Mutilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT IV NEURO FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling– Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT V APPLICATIONS OF COMPUTATIONAL INTELLIGENCE 8

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction**.**

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Upon completion of the course, the student should be able to:
- Apply various soft computing frame works.
- Design of various neural networks.
- Use fuzzy logic.
- Discuss hybrid soft computing

TEXT BOOKS:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education 2004.
2. N.P.Padhy, “Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2006.

REFERENCES:

1. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
2. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989.
3. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
4. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996.
5. Dr.S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India, 2007.
6. Amit Konar, “Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain”, CRC Press, 2008.

PTEC7026 **SPEECH PROCESSING** **L T P C**

3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce speech production and related parameters of speech
- To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech
- To understand different speech modeling procedures such as Markov and their implementation issues
- To introduce speech recognition and synthesis techniques

UNIT I BASIC CONCEPTS **10**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT II SPEECH ANALYSIS **10**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization –Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III SPEECH MODELING **8**

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION **8**

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS **9**

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- To design fundamental algorithms for speech synthesis, coding and recognition
- To design systems for realizing multimedia applications with basic speech signal processing techniques

TEXT BOOKS:

1. Lawrence Rabinerand Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2002.

REFERENCES:
1. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press, 1997.
2. Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, California Technical Publishing, 1997.
3. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education, 2004.
4. Claudio Becchetti and LucioPrinaRicotti, “Speech Recognition”, John Wiley and Sons, 1999.
5. Ben Gold and Nelson Morgan, “Speech and audio signal processing, Processing and Perception of Speech and Music”, Wiley- India Edition, 2006 Edition.

PTGE7074 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM:
To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES:
- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9
Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning--Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement – Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9
The seven traditional tools of quality – New management tools – Six-sigma Process Capability– Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield, Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”,Prentice Hall (India) Pvt. Ltd., 2006.

PTEC7027 VLSI SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To design DSP architectures that are suitable for VLSI implementation for a given algorithm
- To learn high-level algorithms that reduce the number of multipliers, area of implementation and power consumption.
- To address issues related to high performance VLSI architectures such as pipelining styles.

UNIT I PIPELINING AND PARALLEL PROCESSING 9

Introduction to DSP Systems, Typical DSP algorithms, Data flow graph representations, Loop bound and Iteration bound, Longest Path Matrix algorithm; Pipelining and Parallel processing of FIR digital filters, Pipelining and Parallel processing for low power.

UNIT II RETIMING AND ALGORITHMIC STRENGTH REDUCTION 9

Retiming - definitions and properties; Unfolding – an algorithm for Unfolding, properties of unfolding, sample period reduction and parallel processing application; Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, Odd-Even Merge-Sort architecture, Parallel Rank-Order filters.

UNIT III FAST CONVOLUTION AND COMBINED PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS 9

Fast convolution – Cook-Toom algorithm, Modified Cook-Took algorithm; Pipelined and parallel recursive adaptive filters, Look- Ahead pipelining in first- order IIR filters, Look- Ahead pipelining with power-of-two decomposition, Clustered Look-Ahead pipelining, parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters, pipelined adaptive digital filters, relaxed look-ahead, pipelined LMS adaptive filter.

UNIT IV BIT-LEVEL ARITHMETIC ARCHITECTURES 9

Bit-Level Arithmetic Architectures- parallel multipliers with sign extension, parallel carry-ripple array multipliers, parallel carry-save multiplier, 4x 4 bit Baugh-Wooley carry-save multiplication tabular form and implementation, Bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement, Distributed Arithmetic

UNITV NUMERICAL STRENGTH REDUCTION AND WAVE PIPELINING 9

Numerical Strength Reduction – subexpression elimination, Multiple Constant Multiplications, Synchronous pipelining and Clocking styles, Clock skew in edge-triggered single-phase clocking, Wave pipelining.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- To develop efficient DSP algorithms suitable for VLSI implementations
- To effectively modify and develop DSP architectures for VLSI implementations

TEXT BOOK:

1. Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation ", Wiley, Inter Science, 1999.

REFERENCES:

1. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw-Hill, 1994.
2. S.Y. Kung, H.J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.
3. Jose E. France, YannisTsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing ", Prentice Hall, 1994.

PTEC7028 WIRELESS COMMUNICATION NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To understand the working of WI-fi, 3G systems such as UMTS, CDMA 2000
- To learn 4G networks
- To know about ad hoc and sensor network
- To learn about WLAN, WWAN, Wimax and LTE

UNIT I WIRELESS LOCAL AREA NETWORKS 9

Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer- MAC Management Sublayer- Wireless ATM - HIPERLAN- HIPERLAN-2

UNIT II 3G OVERVIEW & 2.5G EVOLUTION 9

Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture,CDMA2000 overview- Radio and Network components, Network structure, Radio network, TD-CDMA, TD-SCDMA.

UNIT III ADHOC & SENSOR NETWORKS 9

Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks- Classification, MAC and Routing protocols.

UNIT IV INTERNETWORKING BETWEEN WLANS AND 3G WWANS 9

Internetworking objectives and requirements, Schemes to connect WLANs and 3G Networks, Session Mobility, Internetworking Architectures for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution system.

UNIT V 4G & BEYOND 9

4G features and challenges, Technology path, IMS Architecture, WiMAX, LTE, Convergent Devices, 4G technologies, Advanced Broadband Wireless Access and Services, Multimedia, MVNO.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Analyze different routing techniques in ad hoc and sensor network
- Demonstrate internetworking between different wireless networks
- Describe 4G features and challenges

TEXT BOOKS:

1. Clint Smith. P.E., and Daniel Collins, —3G Wireless Networks‖, 2nd Edition, Tata McGraw Hill, 2007.
2. Vijay. K. Garg, —Wireless Communication and Networking‖, Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805:, 2007.

REFERENCES:

1. Kaveth Pahlavan, K. Prashanth Krishnamurthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
2. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.
3. Andrew Richardson, —WCDMA design Handbook‖ Cambridge University Press,2007
4. Dharma Prakash Agrawal & Qing-An Zeng, —Introduction to Wireless and Mobile Systems‖,
5. Thomson India Edition, 2nd Ed., 2007.
6. Gary. S. Rogers & John Edwards, —An Introduction to Wireless Technology‖, Pearson Education, 2007.
7. Sumit Kasera and Nishit Narang, — 3G Networks – Architecture, Protocols and Procedures‖, Tata McGraw Hill, 2007.
8. Jochen Schiller, " Mobile Communication", 2nd Edition, Pearson Education Limited 2003
9. C.Siva Ram M Murthy, B.S. Mano, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall PTR, Pearson Education 2004.