	MOHAMED SATHAK A J COLLEGE OF ENGINEERING Chennai 603103	Format no.	TLP 06
		Rev.Date	15/03/20
	LESSON PLAN - THEORY	Rev. No.	0

Department of Civil Engineering			
Name of the Subject	Strength of materials II	Name of the handling Faculty	R.EMILREYAN
Subject Code	CE8402	Year / Sem	II / IV

Course Objective

To know the method of finding slope and deflection of beams and trusses using energy theorems and to know the concept of analysing i

To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

Course Outcome

Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.

Analyze propped cantilever, fixed beams and continuous beams using theorem of three moment equation for external loadings and supp

Analyze the load carrying capacity of columns and stresses induced in columns and cylinders.

Analyze the principal stresses and planes for an element in three dimensional state of stress and study various theories of failure.

Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and find the stresses in curved beams.

Lesson Plan

Sl. No.	Topic(s)	T / R* Book	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc)	Blooms Level (L1-L6)	CO
UNIT I ENERGY PRINCIPLES						
1	Strain energy and strain energy density	T2	1	BB	L1	CO1
2	Strain energy due to axial load (gradual, sudden and impact loadings) , shear, flexure and torsion	T1	2	BB	L2	CO1
3	Castigliano's theorems	T1	1	NPTEL	L3	CO1

4	Maxwell's reciprocal theorem	T1	1	BB	L3	CO1
5	Principle of virtual work -unit load method	T2	1	BB	L5	CO1
6	Application of energy theorems for computing deflections in determinate beams	T1	1	BB	L3	CO1
7	Plane frames and plane trusses – lack of fit and temperature effects	T1	1	BB	L5	CO1
8	Williot Mohr's Diagram	T2	1	PPT	L3	CO1

Suggested Activity: Case Study - Application of energy theorems for computing deflections in determinate beams

Evaluation method : Paper base evaluation

UNIT II INDETERMINATE BEAMS

9	Concept of Analysis	T1	1	BB	L4	CO2
10	Propped cantilever and fixed beams	T1	1	BB	L4	CO2
11	Fixed end moments and reactions	T2	2	BB	L4	CO2
12	Shear force and bending	T1	3	BB	L4	CO2
13	Theorem of three moments	T1	1	PPT	L3	CO2
14	Analysis of continuous beams, shear force and bending moment diagrams.	T2	1	PPT	L4	CO2

Suggested Activity: Assignment -1) Problems on propped cantilever 2) Problems on fixed beam

Evaluation method :Paper base evaluation

UNIT III COLUMNS AND CYLINDER

15	Euler's theory of long columns	T1	1	PPT	L3	CO3
16	critical loads for prismatic columns with different end conditions	T1	2	BB	L4	CO3
17	Rankine-Gordon formula - Eccentrically loaded columns	T2	2	BB	L3	CO3
18	Eccentrically loaded short columns - middle third rule	R4	2	BB	L4	CO3
19	Core section – Thick cylinders – Compound cylinders	R4	2	BB	L3	CO3

Suggested Activity: Assignment -Core section problems

Evaluation method :Paper base evaluation

UNIT IV STATE OF STRESS IN THREE DIMENSIONS

20	Stress tensor at a point – Stress invariants	R2	1	PPT	L3	CO4
21	Determination of principal stresses and principal planes and Volumetric strain	R3	1	PPT	L5	CO1
22	Theories of failure: Maximum Principal stress theory	T2	2	PPT	L4	CO4
23	Maximum Principal strain theory	T1	1	PPT	L2	CO4
24	Maximum shear stress theory	T2	1	PPT	L3	CO4
25	Total Strain energy theory	T2	1	PPT	L3	CO4
26	Maximum distortion energy theory	T1	1	PPT	L3	CO4
27	Application problems.	T2	1	PPT	L3	CO4

Suggested Activity: Tutorial
Problems on Stress invariants & Volumetric strain
Problems on principal stress & strain theory
Total strain energy theory

Evaluation method : Powerpoint presentation base evaluation

UNIT V ADVANCED TOPICS

28	Unsymmetrical bending of beams of symmetrical	T1	2	PPT	L3	CO5
29	Unsymmetrical bending of beams of unsymmetrical sections	T2	2	PPT	L5	CO5
30	Shear Centre	T1	2	PPT	L5	CO5
31	Curved beams	T2	2	PPT	L5	CO5
32	Winkler Bach formula and stresses in hooks.	T1	1	PPT	L4	CO5

Suggested Activity:Tutorial
Problems on symmetrical & unsymmetrical sections
Problems on shearcentre
Problems on curved beams

Evaluation method :Powerpoint presentation base evaluation

Content Beyond the Syllabus Planned

1	**Stability of column**
2	**Basics of fatigue**

Text Books

1	**Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2010.**
2	**Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2012**

Reference Books

1	**Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003**
2	**William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2007.**
	Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
3	**Punmia B.C."Theory of Structures" (SMTS) Vol 1&II, Laxmi Publishing Pvt Ltd, New Delhi 2004.**

Website / URL References

1	http://www.nptelvideos.in/2012/12/strength-of-materials.html

Blooms Level

Level 1 (L1) : Remembering	Lower Order Thinking	Fixed Hour Exams	**Level 4 (L4) : Analysing**		Higher Order Thinking
Level 2 (L2) : Understanding			**Level 5 (L5) : Evaluating**		
Level 3 (L3) : Applying			**Level 6 (L6) : Creating**		

Mapping syllabus with Bloom's Taxonomy LOT and HOT

Unit No	Unit Name	L1	L2	L3	L4	L5	L6	LOT	HOT
Unit 1	**ENERGY PRINCIPLES**	1	1	4	0	2	0	5	3
Unit 2	**INDETERMINATE BEAMS**	0	0	1	5	2	0	6	0
Unit 3	**COLUMNS AND CYLINDERS**	0	1	5	2	0	0	3	2
Unit 4	**STATE OF STRESS IN THREE DIMENSIONS**	0	1	5	1	5	0	6	2
Unit 5	**ADVANCED TOPICS**	0	0	1	1	3	0	3	2

Total	1	3	16	9	12	0	23	9
Total Percentage	3.125	9.375	50	28.125	37.5	0	71.875	28.125

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	2	1	1	0	0	0	0	0	0	0	0	1
CO2	3	2	2	1	0	0	0	0	0	0	0	0	1
CO3	3	2	2	1	0	0	0	0	0	0	0	0	1
CO4	3	2	2	1	0	0	0	0	0	0	0	0	1
CO5	3	2	2	1	0	0	0	0	0	0	0	0	1
Avg	**3**	**2**	**1.8**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**

Justification for CO-PO mapping

CO1	**PO1 : Apply the knowledge of mathematics, science, engineering fundamentals to compute various elastic constantsand stresses , PO2 : Problem analysis in stress and strain, principal stresses and principal planes,PO4 : lags in investigation with applications to beams frames and trusses . PSO1 namely ability to design and analyze the structural components is the students understand the concepts and implement it to get better outcome.**
CO2	**PO1: Knowledge on mechanism of load transfer in indeterminate beams helps in gaining strong engineering knowledge over other methods. This will help in problem solving over different load transfer mechanism on different beams (PO2) development of solution (PO3) and lags in investigation of complex problem like deformations in the beams (PO4).**
CO3	**PO1 : Knowledge in Calculate the deflection of beams by different methods and selection of method for determining slo PO2 : Find the load carrying capacity of columns and stresses induced in columns and cylinders . PO3 : development of compression members .PO4 : investigation of complex problem (PSO1) apply the engineering fundamentals helps in an components**
CO4	**PO1 : Knowledge in determine principal stresses and planes for an element in three dimensional state of stress and stu of failure , PO2 : Problem in determine principal stresses and planes for an element in three dimensional state of stress theories of failure .PO4 : investigation of complex problem**
CO5	**PO1 : Calculating stresses due to unsymmetrical bending helps in applying engineering fundamentals and provides eng for complex problems . PO2 : This will help in problem solving and in designing and analyzing of curved beams helps in development of solution,PO4: investigation of complex problems in unsymmetrical . PSO1 : Applying the engineering f analyze and design the various structural components**

3	**High level**	**2**	**Moderate level**	**1**	Low

*Kindly sign with date

Name & Sign of Faculty Incharge :

Name & Sign of Subject Expert :
Head of the Department :

Format No :231

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Projects / Mini Projects
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different types of of complex problem achieved by making
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ineering solutions ı design . PO3: ındamentals to
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