

# MOHAMMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

COURSE SUMMARY							
Department of Mechanical Engineering							
Name of the Subject	METROLOGY AND MEASUREMENTS			Name of the handling Faculty	Mr.THARANIKUMAR L		
Subject Code	ME 8501			Year / Sem	III / V		
Academic Year	2022-2023			Batch	2020-2024		
Course Objective (Os)							
	To provide knowledge on various Metrological equipments available to measure the dimension of the components.						
	To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.						
Course Outcomes (COs)							
Upon the completion of this course the students will be able to							
CO1	Describe the concepts of measurements to apply in various metrological instruments						
CO2	Outline the principles of linear and angular measurement tools used for industrial applications						
CO3	Explain the procedure for conducting computer aided inspection						
CO4	Demonstrate the techniques of form measurement used for industrial components						
CO5							
Lesson Plan							
Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc )	Cognitive Levels (L1-L6)	COs	POs
		Book					
-	Overview of the course details	-	1	Oral Talk	L1	-	-
UNIT I - INTRODUCTION							
1	Introduction to Metrology – Need .	T1,T2, R1	1	BB	L2	CO1	PO1,PO2,PO7
2	Elements – Work piece,	T1,T2, R1	1	PPT	L2	CO1	PO1,PO2,PO7
3	Instruments-persons-Environment	T1,T2, R1	1	BB	L2	CO1	PO1,PO2,PO7
4	Effect on Precision & Accuracy	T1,T2, R1	1	PPT	L2	CO1	PO1,PO2,PO7
5	Environment – their effect on Precision and Accuracy	T1,T2, R1	1	PPT	L2	CO1	PO1,PO2,PO7
6	Errors – Errors in Measurements	T1,T2, R1	1	PPT	L2	CO1	PO1,PO2,PO7
7	Types – Control of Errors in Measurements	T1,T2, R1	1	PPT	L3	CO1	PO1,PO2,PO7
8	Types of standards	T1,T2, R1	1	PPT	L3	CO1	PO1,PO2,PO7
9	Measuring Instruments	T1,T2, R1	1	PPT	L3	CO1	PO1,PO2,PO7
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any- Quiz							
Evaluation method : Internal Assessment Test, Multiple Choice Questions (MCQs)							
UNIT II - LINEAR AND ANGULAR MEASUREMENTS							
10	Linear Measuring Instruments evolution and Types	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7
11	Linear Measuring Instruments, Classification, Limit gauges	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7
12	Limit gauges,gauge design , terminology procedure	T1,T2, R1	1	PPT	L3	CO2	PO1,PO2,PO7
13	concepts of interchange ability and selective assembly	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7

14	Angular measuring instruments and types	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7
15	Bevel protractor clinometers	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7
16	Angle gauges, spirit levels sine bar	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7
17	Angle alignment telescope	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7
18	Autocollimator and Applications	T1,T2, R1	1	PPT	L2	CO2	PO1,PO2,PO7

**Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any- Assignment**

**Evaluation method :** Internal Assessment Test, Multiple Choice Questions (MCQs)

### UNIT III - ADVANCES IN METROLOGY

19	Linear Measuring Instruments evolution and Types.	T1,T2, R1	1	PPT	L2	CO3	PO1,PO2,PO7
20	laser Interferometers and types	T1,T2, R1	1	PPT	L3	CO3	PO1,PO2,PO7
21	DC and AC Lasers interferometer Applications	T1,T2, R1	1	PPT	L2	CO3	PO1,PO2,PO7
22	Straightness – Alignment	T1,T2, R1	1	PPT	L2	CO3	PO1,PO2,PO7
23	Basic concept of CMM – Types of CMM	T1,T2, R1	1	PPT	L2	CO3	PO1,PO2,PO7
24	Constructional features – Probes of CMM.	T1,T2, R1	1	PPT	L2	CO3	PO1,PO2,PO7
25	CMM Probes – Accessories – Software – Applications	T1,T2, R1	1	PPT	L2	CO3	PO1,PO2,PO7
26	Basic concepts of Machine Vision System	T1,T2, R1	1	PPT	L3	CO3	PO1,PO2,PO7
27	Machine Vision System – Element – Applications.	T1,T2, R1	1	PPT	L4	CO3	PO1,PO2,PO7

**Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any- Quiz**

**Evaluation method :** Internal Assessment Test, Multiple Choice Questions (MCQs)

### UNIT IV - FORM MEASUREMENT

28	Principles and Methods of straightness	T1,T2, R1	1	PPT	L2	CO4	PO1,PO2,PO7
29	Flatness measurement – Thread measurement	T1,T2, R1	1	PPT	L2	CO4	PO1,PO2,PO7
30	Gear measurement- Gear terminology, Gear errors	T1,T2, R1	1	PPT	L2	CO4	PO1,PO2,PO7
31	Gear Measurement, Parkinson Gear Tester	T1,T2, R1	1	PPT	L3	CO4	PO1,PO2,PO7
32	surface finish measurement, Elements of surface texture	T1,T2, R1	1	PPT	L3	CO4	PO1,PO2,PO7
33	Analysis of surface finish, Methods of measuring surface finish	T1,T2, R1	1	PPT	L3	CO4	PO1,PO2,PO7
34	Straightness Measurement and Flatness Testing	T1,T2, R1	1	PPT	L3	CO4	PO1,PO2,PO7
35	Roundness Measurements, Devices used for measurement of roundness	T1,T2, R1	1	PPT	L3	CO4	PO1,PO2,PO7
36	Roundness measuring spindle, Roundness measuring machine, Modern Roundness Measuring Instruments	T1,T2, R1	1	PPT	L3	CO4	PO1,PO2,PO7

**Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any- Case Study**

**Evaluation method :** Internal Assessment Test, Multiple Choice Questions (MCQs)

### TEMPERATURE RELATED PROPERTIES

37	Devices to measure Force,Elastic force meter (Proving Ring),Load cells	T1,T2, R1	1	PPT	L2	CO5	PO1,PO2,PO7
38	Measurement of Induced Strain,Optical Torque Measurement,Reaction Forces in Shaft Bearings	T1,T2, R1	1	PPT	L2	CO5	PO1,PO2,PO7
39	Mechanical Dynamometers,Eddy Current Dynamometer,	T1,T2, R1	1	PPT	L2	CO5	PO1,PO2,PO7
40	Hydraulic or Fluid Friction Dynamometer,Orifice Flow Meter	T1,T2, R1	1	PPT	L2	CO5	PO1,PO2,PO7
41	Venturi Meter,Flow Nozzle,Pitot tube,Rotameter	T1,T2, R1	1	PPT	L2	CO5	PO1,PO2,PO7

42	Mechanical Temperature Measuring Devices,Bimetallic strip thermometer	T1,T2, R1	1	PPT	L2	CO5	PO1,PO2,PO7							
43	Pressure thermometer,THERMOCOUPLES (Thermo-junctive temperature measuring devices)	T1,T2, R1	1	PPT	L2	CO5	PO1,PO2,PO7							
44	Thermocouple Materials,Laws of Thermocouple	T1,T2, R1	1	PPT	L3	CO5	PO1,PO2,PO7							
45	Resistance temperature detectors,Thermistors, Reliability and Calibration – Readability and	T1,T2, R1	1	PPT	L3	CO5	PO1,PO2,PO7							
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any-														
Evaluation method : Internal Assessment Test, Multiple Choice Questions (MCQs)														
Content Beyond the Syllabus Planned														
B1	NPTEL Course Advanced Measuring Instruments													
B2	Non-Destructive testing													
Department of Mechanical Engineering														
T1	Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.													
T2	Jain R.K. “Engineering Metrology”, Khanna Publishers, 2009.													
Reference Books														
R1	Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.													
R2	Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education , 2014.													
R3	Charles Reginald Shotbolt, “Metrology for Engineers”, 5 th edition, Cengage Learning EMEA,1990.													
R4	Donald Peckman, “Industrial Instrumentation”, Wiley Eastern, 2004.													
R5	Raghavendra ,Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.													
Website / URL References														
U1	<a href="https://nptel.ac.in/courses/112/104/112104250/">https://nptel.ac.in/courses/112/104/112104250/</a>													
U2	<a href="https://nptel.ac.in/courses/112/106/112106179/">https://nptel.ac.in/courses/112/106/112106179/</a>													
U3	<a href="https://www.classcentral.com/course/swayam-engineering-metrology-14037">https://www.classcentral.com/course/swayam-engineering-metrology-14037</a>													
Cognitive Levels														
Level 1 (L1) : Remembering		Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analysing					Higher Order Thinking	Projects / Mini Projects				
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	Total				
Unit I	Introduction	0	6	3	0	0	0	9	0	9				
Unit II	Linear and And Angular Measurements	0	8	1	1	0	0	9	1	10				
Unit III	Advances in Metrology	0	6	2	1	0	0	8	1	9				
Unit IV	Form Measurement	0	3	6	0	1	0	9	1	10				
Unit V	Measurement of Power, Flow and Temperature Related Properties	0	7	2	0	0	0	9	0	9				
Total		0	30	14	2	1	0	44	3	47				
Total Percentage		0	63.8	29.787	4.25532	2.13	0	94	6.38298	100				
COs Mapping with POs														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3							3			2	2
CO2	3		3							2			3	3
CO3	3		3							2			1	1

CO4	3		3							2			1	1
CO5	3		3							2			1	1
Avg	3		3							2			2	2
Justification for CO-PO mapping														
CO1	PO1: Explain the basics knowledge of measurements, metrology and measuring devices. PO3: Understand the principle of linear and angular measuring instruments and apply the acquired knowledge for the accurate and precise measurement PO7: Communicating													
CO2	PO1: Explain the basics knowledge of measurements, metrology and measuring devices. PO3: Understand the principle of linear and angular measuring instruments and apply the acquired knowledge for the accurate and precise measurement PO7: Communicating effectively on complex engineering problems to the society strongly													
CO3	PO1: Explain the basics knowledge of measurements, metrology and measuring devices. PO3: Understand the principle of linear and angular measuring instruments and apply the acquired knowledge for the accurate and precise measurement													
CO4	PO1: Explain the basics knowledge of measurements, metrology and measuring devices. PO3: Understand the principle of linear and angular measuring instruments and apply the acquired knowledge for the accurate and precise measurement PO7: Communicating effectively on complex engineering problems to the society strongly													
CO5	PO1: Explain the basics knowledge of measurements, metrology and measuring devices. PO3: Understand the principle of linear and angular measuring instruments and apply the acquired knowledge for the accurate and precise measurement PO7: Communicating effectively on complex engineering problems to the society strongly													
3		High level			2		Moderate level			1		Low level		
Name & Sign of Faculty Incharge : Mr.L.Tharanikumar, Assistance Professor in Mechanical Engineering														
Name & Sign of Subject Expert : Dr.S.Prasath, Associate Professor in Mechanical Engineering														
Head of the Department : Dr.S.Prasath, Associate Professor in Mechanical Engineering														

Format No :231