

Gopalan College of Engineering and Management
Mechanical Engineering

Academic Year: 2016-17

Semesters: EVEN

COURSE PLAN

Semester: **IV** Name of the subject: **MECHANICAL MEASUREMENTS AND METROLOGY**

Subject Code: **15ME46B**

Name of the subject Faculty: HARI PRIYANLA

Name of Subject Expert (Reviewer): FATHIMA PARVEEN

For the Period: From: 13-02-2017 to 19-05-17

Text Books	Engineering Metrology , R.K. Jain Mechanical Measurements , Beckwith Marangoni and Lienhard Instrumentation, Measurement and Analysis , B C Nakra, K K Chaudhry
Reference Books	Metrology & measurement , Anand k bewoor Mechanical measurements & metrology , Dr . T. Chandrasekhar

S.no	Topic Planned	Practical Applications & Brief objectives	Book referred Pg. No	Planned Date	Executed Date	Deviation Reasons theory	How Made Good Reciprocate arrangement	Remarks by HOD	Remarks by Principal
1	MODULE-1 Introduction to Metrology: Definition, objectives and concept of metrology, Need of inspection	Objectives: Students are expected to understand metrology, its advancements & measuring instruments. Acquire knowledge on different standards of length, calibration of End Bars	T:1-6	06-02-17					
2	Principles, process, methods of measurement, Classification and selection of measuring ins and systems.		T:7-11	07-02-17					
3	Accuracy, precision and errors in measurement.	Applications: international standard measuring devices,	R:10-14	09-02-17					

4	System of measurement, Material Standard, Wavelength Standards, Subdivision of standards,	<p>engineering industries, manufacturing any parts, slip gauges, Vernier calipers, yard, meter, comparators, autocollimator</p> <p>Outcomes: Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars. Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator</p>	T:226-233	09-02-17						
5	Line and End standards, Classification of standards and Traceability			10-02-17						
6	calibration of End bars(Numerical), standardization			14-02-17						
7	Linear Measurement and angular measurements: Slip gauges- Indian standards on slip gauge, method of selection of slip gauge,			T:185-189	16-02-17					
8	stack of slip gauge, adjustable slip gauge, wringing of slip gauge			T:190-195	20-02-17					
9	care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112).				21-02-17					
10	Measurement of angles- sine bar, sine center, angle gauges			T:517, 521-531	23-02-17					
11	optical instruments for angular measurements,			T:533-539	23-02-17					
12	Auto collimator-applications for measuring straightness and squareness.				27-02-17					
13	MODULE -2 System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly		<p>Objectives: Students are expected to understand Equipment with knowledge of limits, fits, tolerances and gauging.</p> <p>Applications: screw and nuts, poles, shafts, machine lapping, grinding, boring, gauge blocks, reaming, captain's lathes, press work, sand casting, flame cutting, tube rolling, die casting, rubber molding, ball bearings, gap gauges.</p> <p>Outcomes: to understand the tolerance, limits of size, fits,</p>	T:261-267	28-02-17					
14	Principle of interchangeability and selective assembly,			T:267-270	02-03-17					
15	limits of size, Indian standards, concept of limits of size and tolerances,			T:270-277	03-03-17					
16	definition of fits, hole basis system, shaft basis system, types of fits	T:277-297		04-03-17						
17	their designation (IS 919-1963), geometric tolerance, position-tolerances.			06-03-17						
18	Classification of gauges, brief concept of design of gauges (Taylor's principles),	T:310		07-03-17						

19	Wear allowance on gauges, Types of gauges-plain plug gauge,	geometric and positiontolerances, gauges and their design. Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter	T: 311,301	10-03-17					
20	ring gauge, snap gauge, limit gauge and gauge materials.		T:305	13-03-17					
21	Comparators: Functional requirements, classification, mechanical- Johnson Mikrokator,		T:363-367	14-03-17					
22	sigma comparators, dial indicator, electrical- principles,		T:366-368, 369	16-03-17					
23	LVDT, Pneumatic- back pressure gauges,		T:372	16-03-17					
24	Solex comparators and optical comparators- Zeiss ultra-optimeter.		T:391	17-03-17					
25	MODULE -3 Measurement of screw thread and gear: Terminology of screw threads,	Objectives: Students are expected to understand Screw thread and gear measurement, of screw threads by 2-wire and 3- wire methods, measurements of pitch. Applications: optical flats, bearing industries, rolling pulleys, sprockets, trains, meshes. Medical applications, welding and casting, surveying, garment industry, laser nuclear fusion, communicators, heat treatments, barcode scanners. Outcomes: Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 –wire, 3 – wire methods, screw thread gauges and tool maker’smicroscope Explain measurement of tooth thickness using constant chord method, addendum comparator methods	T:681	20-03-17					
26	measurement of major diameter, minor diameter, pitch, angle		T:687-691	21-03-17					
27	effective diameter of screw threads by 2-wire and 3- wire methods,		T:691-694	23-03-17					
28	best size wire. Screw thread gauges, Tool maker's microscope.		T: 694,790	23-03-17					
29	Gear tooth terminology, tooth thickness measurement using constant chord method,		T: 741,743	27-03-17					
30	Addendum comparator method and base tangent method,		T:744	28-03-17					
31	measurement of pitch, concentricity, run out, and involute profile.		T:751	30-03-17					
32	Gear roll tester for composite error.		T:759	30-03-17					
33	Advances in metrology: Basic concepts of lasers, advantages of lasers,		T:760	31-03-17					
34	laser interferometers, types, applications.		T:425	01-04-17					
35	Basic concepts of Coordinate Measuring	T:792-806	03-04-17						

	Machines-constructional features, applications.								
36	MODULE -4 Measurement systems and basic concepts of measurement methods: Definition, significance of measurement,	Objectives: Students are expected to understand and Acquire knowledge of measurement systems and methods with emphasis on different error measurements, transducers, intermediate modifying and terminating devices, amplifiers, oscilloscope, oscillography Applications: Antenna,AccelerometersAir flow sensorsElectroactive polymersRotary motors, linear motorsGalvanometersrotary variably differential transformersLoad cells ,Microelectromechanical systemsPotentiometersPressure sensorsString potentiometers Outcomes: Explain measurement systems, transducers, intermediate modifying devices and terminating devices	T:10-16	04-04-17					
37	generalized measurement system, definitions and concept of accuracy, precision,		06-04-17						
38	calibration, threshold, sensitivity, hysteresis, repeatability linearity.		06-04-17						
39	loading effect, system response-time delay		T:16-29	07-04-17					
40	Errors in measurement, classification of errors.		T:30-33	10-04-17					
41	Transducers, transfer efficiency, primary and secondary transducers		R:172-176	11-04-17					
42	electrical, mechanical, electronic transducers, advantages of each type transducers.		R:176-186	13-04-17					
43	Intermediate modifying and terminating devices: Mechanical systems, inherent problems		R:187-189	20-04-17					
44	electrical intermediate modifying devices, input circuitry		R:189-196	20-04-17					
45	ballast circuit, electronic amplifiers			21-04-17					
46	Terminating devices, Cathode ray oscilloscope, Oscillography.		24-04-17						
47	MODULE -5Force, Torque and Pressure Measurement: Direct methods and indirect method, force measuring instruments	Objectives: Students are expected to understand and the measurement of Force, Torque, Pressure, Temperature and Strain. types of dynamometers Bridgeman gauge, measuring devices of power and pressure	R:232-235	25-04-17					
48	Torque measuring inst., Types of dynamometers		R:236-241	27-04-17					
49	Absorption dynamometer, Prony brake		R:242-243	27-04-17					

	and rope brake dynamometer	Applications: electromagnetic brake, engines, chassis, electric motor, generator, fan breaks, testing of engines, measuring gauges, thermocouples, pressure indication, power indicator, pyrometers Outcomes: Describe functioning of force, torque, pressure, strain and temperature measuring devices. law of thermocouple, materials used for construction, pyrometer, optical pyrometer								
50	Power measuring instruments		R:249-255	28-04-17						
51	Pressure measurement, principle, use of elastic members, Bridgeman gauge,			02-05-17						
52	McLeod gauge, Pirani gauge.			04-05-17						
53	Measurement of strain and temperature: Theory of strain gauges, types, electrical resistance strain gauge		R:270-272	04-05-17						
54	preparation and mounting of strain gauges,		R:280	05-05-17						
55	gauge factor, methods of strain measurement.			08-05-17						
56	Temperature Compensation, Wheatstone bridge circuit,			09-05-17						
57	orientation of strain gauges for force & torque		R:273-276	11-05-17						
58	Strain gauge based load cells and torque sensors.		R:276-281	11-05-17						
59	Resistance thermometers, thermocouple	R:259-263	12-05-17							
60	law of thermocouple,	R:263	18-05-17							
61	materials used for construction, pyrometer, optical pyrometer.	R:270-271	19-05-17							

Prepared By: _____ Reviewed by: _____
(Faculty) (Sub. expert)
Date & Sign _____ Date & Sign _____

Approved by: _____ Approved by: _____
(HOD) (Principal/ Acad. Co)
Date & Sign _____ Date & Sign _____