

## B.E Semester: 4 Mechanical Engineering

### Subject Name: Mechanical Measurement & Metrology (MA405-N)

**A. Course Objective:**

- To present a problem oriented in depth knowledge of Mechanical Measurement and Metrology
- To address the underlying concepts and methods behind Mechanical Measurement and Metrology

**B. Teaching / Examination Scheme:**

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
3	0	2	5	4	3	70	30	20	30	150

**C. Detailed Syllabus:**

Unit No.	Details
1	Basic Concepts of Measurements: Introduction to measurement and measuring instruments, Methods of measurement, Modes of measurement, generalized measuring system and functional elements, instruments and its classifications, Static and dynamic performance characteristics of measurement devices, sources of error in measurement, classification and elimination of errors, uncertainty in measurements
2	Measurement of Displacement, Velocity/Speed, Acceleration Force, Torque, Power and Strain measurement: Measurement of displacement, velocity, acceleration and vibrations, by potentiometer, strain gauges, seismic pick ups, velocity pickups and acceleration pickups, calibration of pick ups. Force measurement: Torque and shaft power measurement, Basic method of force measurements, elastic force transducers, torque measurement on rotating shaft, shaft power measurement. Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, temperature compensation.
3	Temperature Measurement: Measurement of temperature by liquid - in - glass thermometers, pressure thermometers, thermocouples, their calibration, resistance thermometer, Bimetallic thermometer, thermistors, radiation and optical pyrometers
4	Standards of measurements. Limits, fits, tolerances and allowances. IS for limits and fits.. Gauges: Gauges including their design IS for plug & ring gauges. Interchangeable manufacturing. Machine –tool metrology and alignment tests of different machine tools Measuring instruments: Linear measuring instruments, angular measuring instruments, measurement of flatness- interferometer, angle dekkor and autocollimator, triple scan alignment laser which measure flatness, squareness, straightness and parallelism.
5	Amplifying devices and comparators: Tool makers microscope, profile projector, pneumatic comparators, optical comparator, electric and electronic comparator ( Brooks level, Eden rolt, Johenson Mikrokrator, Sigma, optical comparator, Mercer air gauge, multi check comparator)

6	Surface assessment: Surface texture, general errors of form, components of surface texture, parameters used in surface roughness measurement, need for surface roughness measurement, electronics stylus instrument, Tomlinson surface meter, Taylor- Hobson Talysurf, light interference microscope, Mecrin instrument.
7	Gear measurement: Errors in spur gear such as run out, pitch, profile, lead, backlash, tooth thickness, concentricity, alignment and composite errors, pitch measuring instruments, gear tooth vernier, profile measurement (David - Brown tangent comparator) Screw thread measurement: Screw thread measuring elements, Measurement of effective diameter, Two wire system and three wire system of measurements, diameter measuring machines, measurement of pitch and pitch errors.

<b>Total hours (Theory):48</b>
<b>Total hours (Practical):32</b>
<b>Total hours:80</b>

#### D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1 <sup>st</sup> ,2 <sup>nd</sup> ,3 <sup>rd</sup>	Unit 1	20%	1,2
2	4 <sup>th</sup> ,5 <sup>th</sup> ,6 <sup>th</sup>	Unit 2	20%	3,4
3	7 <sup>th</sup> ,8 <sup>th</sup> ,9 <sup>th</sup>	Unit 3	20%	5,6
4	10 <sup>th</sup> ,11 <sup>th</sup> ,12 <sup>th</sup>	Unit 4	20%	7,8,9
5	13 <sup>th</sup> ,14 <sup>th</sup> ,15 <sup>th</sup> ,16 <sup>th</sup>	Unit 5	20%	10,11,12

#### E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures. Suggested list of experiment is given below

#### F. List of Practical

1	To get acquainted with Sine Bar
2	To calibrate the micrometer
3	To measure the Gear tooth thickness of spur gear with the help of Gear Tooth Vernier Caliper (GTVC)
4	Review of precision Measuring Instruments (PMIS)

5	To Study the Acceptance Test for Machine Tool (Lathe)
6	To get acquainted with Tool maker microscope, Profile Projector, Angle Dekkor.
7	To get acquainted with Interferometer
8	To measure tool forces using Lathe tool Dynamometer
9	To measure of surface roughness with surface roughness measuring instrument.

G. Students Learning Outcomes:

1	Recognize basic concept of measurement and identify use of instruments for scientific use.
2	Apply methods of measurement for various physical quantities.
3	Use of instruments for linear, angular, surface roughness, measurement.
4	Use of devices for gear, screw measurement.
5	Understand limit and limit gauging
6	Inspect the alignment of machine tools.
7	Use of amplifying devices for various applications.

H. Text Books & Reference Books:

1	A Text Book Of Engineering Metrology by R.K.Jain , Khanna Publishers,Delhi
2	Mechanical Measurement and Control by D.S.Kumar, Metropolitan Book Pub.
3	Dimensional Metrology by Khare And Vajpayee
4	Instrumentation by N. Chaudhari
5	Mechanical Measurements by Doebelin
6	Metrology For Engineers by Galyer And Shotblot (ELBS)
7	Mechanical Measurement and Instrumentation by R.K.Rajput, S.K.Katariya Pub.
8	K.J. Hume, “Engineering Metrology”, Macdonald and Co.(publisher) London
9	Smith GT, “Industrial Metrology”, Springer (2002)
10	Jay. L. Bucher (ed),“The Metrology Hand book”, American Society for Quality (2004).
11	D. M. Anthony, “Engineering Metrology”, Pergamon Press