

B. E. Semester: IV
Automobile Engineering
Subject Name: MECHANICAL MEASUREMENT AND INSTRUMENTATION (AE405)

Course Objective:

- To present a problem oriented in depth knowledge of MECHANICAL MEASUREMENT AND INSTRUMENTATION
- To address the underlying concepts and methods behind MECHANICAL MEASUREMENT AND INSTRUMENTATION

Teaching / Examination Scheme:

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
AE405	MECHANICAL MEASUREMENT & INSTRUMENTATION	3	0	2	5	4	3	70	30	20	30	150

Detailed Syllabus:

(A) **Metrology**

- 1 **General:** Standards of measurements. Sources of error in measurements. Limits, fits, tolerances and allowances. IS for limits and fits. Machine –tool metrology and alignment tests of different machine tools.
- 2 **Measuring instruments:** Linear measuring instruments, angular measuring instruments, measurement of flatness- interferometer, angle deckor and autocolimator, triple scan alignment laser which measure flatness, squareness, straightness and parallelism.
- 3 **Gauges:** Gauges including their design IS for plug & ring gauges. Interchangeable manufacturing.
- 4 **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)
- 5 **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.

- 6 **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)
- 7 **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) Mechanical Measurement:

- 1 **Measurement:** Measurement of displacement, velocity, acceleration and vibrations, by potentiometer, strain gauges, seismic pick ups, velocity pickups and acceleration pickups, calibration of pick ups.
- 2 **Force measurement :** Torque and shaft power measurement, Basic method of force measurements, elastic force transducers, torque measurement on rotating shaft, shaft power measurement.
- 3 **Pressure measurement:** Comparative study of different types of manometers, sensitivity of manometers, comparison of water, mercury and oil as a manometric fluid, Air micro manometers, sonar manometers, low pressure gauges such as McLeod gauge, Thermal conductivity gauge, Pirani gauge, Ionization Gauge, Piezo-electric pressure transducers, Elastic Transducers, Force balance Transducers. Dead weight gauges, elastic transducers and force balance transducer.
- 4 **Flow measurement :** Gross flow rate measuring meters, constants area, variable pressure drop meters (obstruction meters), local flow velocity magnitude and direction meters, Hot-wire anemometer velometer,
- 5 **Temperature Measurement:** Measurement of temperature by liquid - in - glass thermometers, pressure thermometers, thermocouples, their calibration, resistance thermometer, Bimetallic thermometer, thermistors, radiation and optical pyrometers.

Lesson Planning:

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1 st , 2 ^{ed} , 3 ^{ed}	Unit 1	20 % .	A1,A2
2	4 th , 5 th , 6 th	Unit 2	20 %	A3,A4,A5
3	7 th , 8 th , 9 th	Unit 3	20 %	A6,A7,B1
4	10 th , 11 th , 12 th	Unit 4	20 %	B2,B3
5	13 th , 14 th , 15 th	Unit 5	20 %	B4,B5

Instructional Method & Pedagogy:

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- 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.
- 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.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures. Experiments shall be performed in the laboratory related to course contents. Suggested list of experiment is given below
 1. To Calibrate the pressure gauge with Dead weight Gauge Tester
 2. To get acquainted with Sine Bar
 3. To calibrate the micrometer
 4. To measure the Gear tooth thickness of spur gear with the help of Gear Tooth Vernier Caliper (GTVC)
 5. Review of precision Measuring Instruments (PMIS)
 6. To Study the Acceptance Test for Machine Tool (Lathe)
 7. To get acquainted with Tool maker microscope, Profile Projector, Angle Dekkor.
 8. To get acquainted with Interferometer
 9. To Calibrate thermocouples.
 10. To study of surface roughness with surface roughness measuring instrument.

Students Learning Outcomes:

- The student can identify different areas of MECHANICAL MEASUREMENT AND INSTRUMENTATION
- Can find the applications of all the areas in day to day life.

Recommended Study Materials

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.