

M.E Semester: 1 Mechanical Engineering (Thermal Engineering)
Subject Name: INSTRUMENTATION FOR ENGINEERS

A. Course Objective

- To present a problem oriented in depth knowledge of Instrumentation For Engineers
- To address the underlying concepts and methods behind Instrumentation For Engineers

B. 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	
METH104	Instrumentation for Engineers	3	0	2	5	4	3	70	30	20	0	120

C. Detailed Syllabus

1. Significance of Measurement and Instrumentation: Introduction; generalized configuration and functional stages of measuring systems. The transducer and its environment; an overview; sensing process and physical laws. Types of measurement problems, Transducer classification and their modeling; Information, Energy and Incremental Models; Characteristics of instruments, design and selection of components of a measuring system.
2. Dynamic Response of Instruments: Mathematical model of a measuring system, response of general form of instruments to various test inputs; time-domain and frequency domain analysis. Elementary transfer functions and Bode plots of general transfer functions.
3. Errors in Measurement and its Analysis: Causes and types of experimental errors; systematic and random errors. Uncertainty analysis; computation of overall uncertainty; estimation for design and selection for alternative test methods.
4. Transducers and Transduction Principles: Developments in sensors, detectors and transducer technology; displacement transducers; force, torque and motion sensors; piezoelectric transducers; capacitive type transducers; Strain gage transducers; accelerometers, pressure transducers based on elastic effect of volume and connecting tubing.
5. Data acquisition and Signal Processing: Systems for data acquisition and processing; modules and computerized data system; digitization rate, time and frequency domain representation of signals, and Nyquist criterion.
6. Flow measurement: Flow visualization, shadowgraph; schlieren and interferometric techniques; Pilot static tubes; hot wire anemometers; Laser Doppler velometer; flow measurements using Coriolis Effect.
7. Temperature and Heat Flux Measurement: Thermoelectric sensor; electric resistance sensor; thermistors; radiations pyrometer; Temperature measuring problem in flowing fluids, dynamic compensation.

D. Detailed Syllabus / Lesson Planning

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1 st , 2 nd , 3 rd	Unit 1	20 %	1
2	4 th , 5 th , 6 th	Unit 2	20 %	2,3
3	7 th , 8 th , 9 th	Unit 3	20 %	4
4	10 th , 11 th , 12 th	Unit 4	20 %	5
5	13 th , 14 th , 15 th	Unit 5	20 %	6,7

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. List of Experiments:
 1. STUDY OF DISPLACEMENT TRANSDUCER.
 2. PRESSURE TRANSDUCER.
 3. AC BRIDGE- SCHERING'S BRIDGE .
 4. AC BRIDGE- MAXWELL'S INDUCTANCE,CAPACITANCE BRIDGE.
 5. DC BRIDGES -WHEATSTONE BRIDGE
 6. DC BRIDGES -KELVINS DOUBLE BRIDGE
 7. INSTRUMENTATION AMPLIFIER
 8. A/D CONVERTER AND D/A CONVERTER
 9. STUDY OF TRANSIENTS
 10. CALIBRATION OF SINGLE-PHASE ENERGY METER
 11. MEASUREMENT OF THREE-PHASE POWER ANDPOWER FACTOR
 12. CALIBRATION OF CURRENT TRANSFORMER
 13. MEASUREMENT OF IRON LOSS
 14. ULTRASONIC MEASUREMENT TECHNIQUES

F. Students Learning Outcomes

- The student can identify different areas of Instrumentation for Engineers.
- Can find the applications of all the areas in day to day life.

G. Recommended Study Materials

- **Text & Reference Books:**
 1. Measurement System Application and Design by Doebelin, McGraw Hill Publication.
 2. Experimental Methods for Engineers by Holman J.P., McGraw Hill Publication.
 3. Transducers in Mechanical and Electronic Design by Harry L. Trietly, Marcel Dekker.
 4. Data Acquisition for Signal Analysis by Yuen, John Wiley and Sons.
 5. Mechanical Measurements (Fifth Edition) by Beckwith, Marangoni and Lienhard, Addison Wesley
 6. Measurement in Heat Transfer by Eckert and Goldstein, McGraw Hill Publication.
 7. Fluid Mechanics Measurement by Goldstein, Hemisphere