INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad 500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY**				
Course Code	AME116				
Programme	B.Tech				
Semester	VII	ME			
Course Type	Core				
Regulation	IARE R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
				3	2
Chief Coordinator	Dr. P Raghavulu, Professor				
Course Faculty	Dr. P Raghavulu, Professor Mr. VKVS Krishnam Raju, Assistant Professor				

I. COURSE OVERVIEW:

The primary objective of this course is to study and calibrate measuring instruments used in engineering industry. Understanding the principles involved in various measuring transducers used in flow, linear, angular, speed, temperature, Pressure, Strain, and Vibration. Selection of suitable measuring instrument for any process control application.

II. COURSE PREREQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AME110	V	Machine Tools and Metrology Lab	2

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Instrumentation and Control Systems Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & Talk	✘	Quiz	✘	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	**Laboratory**		**Total Marks**
Type of Assessment	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	**Performance**	**Calculations and Graph**	**Results and Error Analysis**	**Viva**	**Total**
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Exercise, Discussion and Seminars
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Exercise, Discussions
PO 3	**Design/development of solutions:** Competence to design a system, component or process to meet societal needs within realistic constraints.	2	Exercise, Discussion and Seminars

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	2	Lab Experiments
PSO 2	Problem solving skills: An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	2	Mini projects
PSO 3	**Successful career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become technocrats..		

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand basic principles of instrumentation and control systems
II	Apply calibration of measuring instruments for linear and angular displacement.
III	Understand calibration of measuring instruments for temperature
IV	Apply calibration of measuring instruments of flow and speed measurement
V	Understand the functioning of strain gauges for measuring pressure and vibration

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AME116.01	CLO 1	Calibration of angular displacement.	PO1, PO2, PO3	2, 2, 3
AME116.02	CLO 2	Calibration of linear displacement.	PO1, PO2, PO3	3, 3, 2
AME116.03	CLO 3	Analyze and calibration curve of RTD for Temperature measurement.	PO1, PO2, PO3	2,3,2
AME116.04	CLO 4	Calibration of thermister for temperature measurement.	PO1, PO2, PO3	3, 2, 2
AME116.05	CLO 5	Evaluate calibration process of thermister for temperature measurement.	PO1, PO2, PO3	2, 3, 2
AME116.06	CLO 6	Analyze the calibration of pressure gauge for pressure.	PO1, PO2, PO3	3, 2, 3
AME116.07	CLO 7	Computation and study of strain gauge.	PO1, PO2, PO3	2, 3, 3
AME116.08	CLO 8	Evaluation of speed pickup.	PO1, PO2, PO3	3, 3, 2

AME116.09	CLO 9	Calibration of flow meter.	PO1, PO2, PO3	3, 2, 3
AME116.10	CLO 10	Characteristic study of vibration.	PO1, PO2, PO3	3, 2, 2
AME116.11	CLO 11	Analyze the calibration curve of low pressure measurement using McLeod Gauge.	PO1, PO2, PO3	3, 2, 2

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X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	2	2	3												
CLO 2	2	2	2										2		
CLO 3	2	3	2											2	
CLO 4	3	2	2										2		
CLO 5	2	3	2											3	
CLO 6	2	2	3											2	
CLO 7	2	3	2										3		
CLO 8	3	2	2												
CLO 9	3	2	2											2	
CLO 10	3	2	2											2	
CLO 11	2	2	3										2		

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2, PO3, PSO1, PSO2	SEE Exams	PO 1, PO 2, PO3, PSO1, PSO2	Assignments	-	Seminars	-
Laboratory Practices	PO 1, PO 2, PO3, PSO 1, PSO 2	Student Viva	PO 1, PO 2, PO 3, PSO 1, PSO 2	Mini Project	-	Certification	-

XII. ASSESSMENT METHODOLOGIES INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

LIST OF EXPERIMENTS	
Week-1	**CALIBRATION OF CAPACTIVE TRANSDUCER**
Calibration of capacitive transducer for angular measurement.	
Week-2	**CALIBRATION OF LVDT**
Study and calibration of LVDT transducer for displacement measurement.	
Week-3	**STUDY OF RESISTANCE TEMPERATURE DETECTOR**
Study of resistance temperature detector for temperature measurement.	
Week-4	**CALIBRATION OF THERMISTOR**
Calibration of thermister for temperature measurement.	
Week-5	**CALIBRATION OF THERMOCOUPLE**
Calibration of thermocouple for temperature measurement.	
Week-6	**CALIBRATION OF PRESSURE GUAGE**
Calibration of Pressure gauges.	
Week-7	**CALIBRATION OF STRAIN GUAGE**
Calibration of strain gauge for temperature measurement.	
Week-8	**CALIBRATION OF PHOTO SPEED PICKUP**
Study and calibration of photo speed pickups for the measurement of speed.	
Week-9	**CALIBRATION OF ROTAMETER**
Study and calibration of rotameter for flow measurement.	
Week-10	**CALIBRATION OF VIBROMETER**
Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various Loads.	
Week-11	**MEASUREMENT OF VACUUM**
calibration of Mcleod gauge for low pressure.	
Week-12	**CALIBRATION OF MAGNETIC SPEED PICKUP**
Study and calibration of magnetic speed pickups for the measurement of speed.	
Reference Books:	
1. D.S.Kumar,–MeasurementSystems:Applications&Design‖,AnuradhaAgencies,1st Edition,2013. 2. C.Nakra,K.K.Choudhary,–Instrumentation,Measurement&Analysis‖,Tata McGrawHill, 1st Edition,2013.	
Web References:	
1.	http://www.nptelvideos.in/

XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Week	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Calibration of capacitive transducer for angular measurement.	PO1, PO2, PO3	
2	Study and calibration of LVDT transducer for displacement measurement	PO1, PO2, PO3	PSO 1
3	Study of resistance temperature detector for temperature measurement.	PO1, PO2, PO3	PSO 2
4	Study of resistance temperature detector for temperature measurement.	PO1, PO2, PO3	PSO1
5	Calibration of thermocouple for temperature measurement.	PO1, PO2, PO3	PSO2
6	Calibration of Pressure gauge.	PO1, PO2, PO3	PSO2
7	Calibration of strain gauge for temperature measurement.	PO1, PO2, PO3	PSO1
8	Study and calibration of photo speed pickups for the measurement of speed.	PO1, PO2, PO3	
9	Study and calibration of rotameter for flow measurement.	PO1, PO2, PO3	PSO2
10	Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.	PO1, PO2, PO3	PSO 2
11	Study and calibration of Mcleod gauge for low pressure.	PO1, PO2, PO3	PSO1
12	Study and calibration of magnetic speed pickups for the measurement of speed.	PO1, PO2, PO3	

XV. GAPS IN THE SYLLABUS TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	For the better understanding can go through the process control systems	NPTEL & Exercise Practices	PO1, PO2	PSO1
2	Visit industry for better understanding of modern control systems.	Industrial visits	PO1, PO2	PSO2

Prepared by:

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