

University of Mumbai			
CLASS: T.E. (Electronics Engineering)		Semester - VI	
SUBJECT: Electronics Instrumentation Systems			
Periods per week (each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	3	-
	Oral Examination	-	25
		Term Work	25
		Total	150

Objective	An undergraduate course on instrumentation systems in some form is regarded as an essential element of study for all electronic engineering students. A balance must be drawn between the diversity of sensors that are presented and the diversity of electronic signal processing techniques included so that a strong link with other courses is maintained.	
Pre-requisite	System of units, Measuring Instruments, Measurement of Inductance and Capacitance AC bridges -	
Module	Contents	Hours
1	Instrumentation System <ul style="list-style-type: none"> • Basic characteristics of Instruments: static and dynamic. • Classification of Instruments. • Response for standard inputs: Unit step , Ramp and sinusoidal signals • Performance characteristics and • Error analysis of measuring system 	08

2	<p>Transducers</p> <ul style="list-style-type: none"> • Requirement of Transducers. • Classification of transducers • Advantages of Electrical Transducer. • Transducer used for measurement of different physical parameters such as : displacement, strain, temperature, pressure, flow, speed, accelerator, vibration, weight, level, sound, force and torque. • Sensors used in analytical measurement of PH, viscosity, Humidity and dew point. 	10
3	<p>Signal Generation and Conditioning system</p> <ul style="list-style-type: none"> • Various signal generators and its implementation, • Active and passive filters. • Filter design for different applications. • Switch capacitor filter. • Logarithmic amplifier. • Instrumentation amplifier with programmable gain, • Window comparator. • Input -output protection circuit. • Frequency to voltage and voltage to frequency converters. • Current to voltage and voltage to current converters • Data converters. 	09

4	<p>Data Acquisition System and Advances in Instrumentation systems</p> <ul style="list-style-type: none"> • Single channel data acquisition, • Multi-channel data acquisition systems, • Monitoring Instruments : Indicators, Alarm, Recorders • Data Logger, • PC-based Instrumentation System, • HMI, SCADA. • Virtual Instrumentation: concept and applications • Distributed Control System (DCS) 	10
5	<p>Controllers</p> <ul style="list-style-type: none"> • Manipulations Devices, • The control valves, Valve characteristics, • Solenoid, • Servomechanism and DC and AC Motor. • Continuous and Discontinuous controller • Proportional controller. Proportional Band, • RESET controller • Rate controller • Composite controller. • Cascade controller, • Feed-forward controller 	06
6	<p>Calibration of Instruments and Controller Tuning</p> <ul style="list-style-type: none"> • Need of Instrument Calibration. • Preparation for calibration. • Standard calibration procedure. • Five point calibration procedure. • Controller tuning: need and different method of controller tuning. 	05

Text Books:

1 Instrumentation Devices and Systems

By C S Rangan, G R Sarma, V S V Mani
2nd Edition Tata McGrawhill Publication

2 Process Control System and Instrumentation

By Terry Barlett DELIMAR CENGAGE learning Reprint-2008

Additional Reading:

1 Principles of Industrial Instrumentation and Control Systems

By Chennakesava R. Alavala DELIMAR CENGAGE learning Reprint-2008

2 Instrumentation, Measurement and Analysis

By B C Nakra K K Chaudhary 2nd Edition Tata McGrawhill Publication

3 Measurement Systems Applications and Design

By E O Doebelin 4th Edition Tata Mc-graw Hill ,1990

4 Learning with LabVIEW TM7

By Robert H. Bishop Express Pearson Education Publication

5. Instrumentation for Engineer and Scientist

By John D Turner Martyn Hill Oxford Unniversity Press

Suggested List of Experiments:

- 1 To study the Response of different instruments for different test inputs (Unit , Ramp and sinusoidal signals) USE EITHER MATLAB/ LabVIEW
- 2 Study the characteristics of different transducers (Two to Four Experiments can be performed to include transducers in Chaper-2)
- 3 Design of filter (2nd order Butherworth) with discrete components Response can be also observed using VI in LabVIEW
- 4 Design of Instrumentation Amplifier.
- 5 Study of controller modes or PID controller (Either on Trainer kit or Constructing VI on LabVIEW)
- 6 Experiment to show calibration of Instrument and tuning of Controller

Termwork:

The term-work shall consist of at least eight laboratory experiments covering the whole of syllabus, duly recorded and graded. The guidelines for carrying out the experiments is as given below

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal)	: 10 marks.
Test (at least one)	: 10 marks.
Attendance (Practical and Theory)	: 05 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Oral Examination:

Oral will be based on any experiment performed from the list of experiment given in the syllabus and the entire syllabus.

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
4. Question number 1 will be compulsory and will cover all modules.
5. Remaining questions will be from the same module or mixed in nature. (e.g.- suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
6. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
7. No question should be asked from pre-requisite module