

Techno India NJR Institute of Technology



Course File

Electronics Measurement & Instrumentation (4EC3-06)

For Techno India NJR Institute of Technology
पंकज पोखवाल
Dr. Pankaj Kumar Porwal
(Principal)

Pradeep Chhawchharia
(Professor)
Department of ECE



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

II Year - IV Semester: B.Tech. (Electronics & Communication Engineering)

4EC3-06: Electronics Measurement & Instrumentation

Credit: 3

Max. Marks: 150(IA:30, ETE:120)

3L+0T+0P

End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	THEORY OF ERRORS - Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors, Modeling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors.	8
3	ELECTRONIC INSTRUMENTS - Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, and Component Measuring Instruments: Q meter, Vector Impedance meter, RF Power & Voltage Measurements, Introduction to shielding & grounding.	8
4	OSCILLOSCOPES – CRT Construction, Basic CRO circuits, CRO Probes, Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes.	7
5	SIGNAL GENERATION AND SIGNAL ANALYSIS - Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators. Signal Analysis - Measurement Technique, Wave Analyzers, and Frequency - selective wave analyser, Heterodyne wave analyser, Harmonic distortion analyser, and Spectrum analyser.	8
6	TRANSDUCERS - Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers:- RTD, Thermocouples, Thermistors, LVDT, Strain Gauges, Bourdon Tubes, Seismic Accelerometers, Tachogenerators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.	8
Total		40

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Course Overview:

The measurement of any quantity plays very important role not only in science but in all branches of engineering, medicine and in almost all the human day to day activities. The technology of measurement is the base of advancement of science. The role of science and engineering is to discover the new phenomena, new relationships, the laws of nature and to apply these discoveries to human as well as other scientific needs. The science and engineering is also responsible for the design of new equipments. The operation, control and the maintenance of such equipments and the processes is also one of the important functions of the science and engineering branches. All these activities are based on the proper measurement and recording of physical, chemical, mechanical, optical and many other types of parameters. The measurement of a given parameter or quantity is the act or result of a quantitative comparison between a predefined standard and an unknown quantity to be measured. The major problem with any measuring instrument is the error. Hence, it is necessary to select the appropriate measuring instrument and measurement procedure which minimises the error. The measuring instrument should not affect the quantity to be measured. An electronic instrument is the one which is based on electronic or electrical principles for its measurement function. The measurement of any electronic or electrical quantity or variable is termed as an electronic measurement.

Course Outcomes:

CO.NO.	Cognitive Level	Course Outcome
1	Comprehension	Describe principles of operation and working electronics instrument.
2	Application	Design and Develop transducers in different types of field of applications.
3	Analysis	Analyze different electrical/electronic parameters using state of equipments of measuring instruments which is require to all types of industries.
4	Synthesis	Develop digital energy meter using MSP 430 microcontroller.
5	Evaluate	Evaluate standard deviation and mean of error of electronic measuring instrument .

Prerequisites:

1. Fundamentals knowledge of KVL and KCL.
2. Fundamentals knowledge of Statics (Mean, mode, median).
3. Fundamental knowledge of Fourier Transform.

Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcomes (PO's)											
	Domain Specific					Domain Independent						
CO. NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	0	0	0	0	0	0	0	0	0
CO2	2	2	2	3	0	0	0	0	0	0	0	0
CO3	2	3		0	0	0	0	0	0	0	0	0
CO4	2	1	1	0	0	0	2	0	0	0	0	0
CO5	3	1		0	0	0	0	0	0	0	0	2

1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)

Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	INTRODUCTION: Objective, scope and outcome of the course.
2	2	THEORY OF ERRORS: Accuracy and precision
3	2	Repeatability
4	2	Limit of error
5	2	Systematic & random errors, Modeling of error
6	2	Probable error & standard deviation
7	2	Gaussian error analysis, Combination of error, Numerical problem related to error
8	3	ELECTRONICS INSTRUMENTS: Electronic voltmeter
9	3	Electronic multimeters
10	3	Digital voltmeter, Types of digital voltmeter
11	3	Component measuring instruments: Q meter
12	3	Vector impedance meter

13	3	RF power & Voltage Measurement
14	3	Introduction to shielding, Introduction to grounding
15	4	OSCILLOSCOPES: CRT construction
16	4	Basic CRO circuits
17	4	CRO Probes, Types of CRO probes
18	4	Techniques of measurement of frequency
19	4	Phase angle and time delay,
20	4	Multibeam and multi trace CRO
21	4	Storage & sampling oscillator
22	4	Numerical problem related to CRO
23	5	SIGNAL GENERATOR AND SIGNAL ANALYSIS: introduction
24	5	Sine wave generator
25	5	Frequency synthesized signal generators
26	5	Sweep frequency generator
27	5	Signal analysis measurement techniques, Wave analyzer
28	5	Frequency selective wave analyzer, Heterodyne wave analyzer
29	5	Harmonic distortion analyzer, Spectrum analyzer
30	6	TRANSDUCERS: classification of transducer
31	6	Characteristics of transducers
32	6	Construction, working principle and application of RTD
33	6	Construction, working principle and application of thermocouple, thermistor
34	6	Construction, working principle and application of LVDT
35	6	Construction, working principle and application of strain gauges
36	6	Construction, working principle and application of Bourdon tube, seismic accelerometers
37	6	Construction, working principle and application of Tacho generator
38	6	Construction, working principle and application of load cell
39	6	Construction, working principle and application of

		piezoelectric transducers
40	6	Construction, working principle and application of ultrasonic flow meter

Assessment Methodology:

1. Two Midterm exams where student have to showcase subjective learning.
2. Final Exam (subjective paper) at the end of the semester.

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3E1494

Roll No. _____

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3E1494

B.Tech. III Semester (Main/Back) Examination - 2014
Electronics & Comm.
3EC4 Electronics Measurements & Instrumentation
(Common for Main & Back of 3EC4 and 3BM4 (M&B) (Old
Back Only))

Time : 3 Hours**Maximum Marks : 80**
Min. Passing Marks : 24**Instructions to Candidates:**

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. a) What is meant by normal distribution of error. Define probable error. (8)
b) Explain the limiting errors with suitable examples and derive the expression for relative limiting error. (8)

OR

1. a) Explain the following with suitable examples.
i) Standard deviation
ii) Probable error of the mean (8)
b) Explain the following:
i) Systematic errors
ii) Random errors (8)

Unit - II

2. a) Explain the block diagram of electronic Multimeters and its applications. (8)
b) Define the following terms (8)
i) Grounding
ii) Shielding

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OR

2. a) Explain the block diagram of full wave bridge rectifier type of electronic voltmeters. (8)
b) Discuss about one method to measure voltage and power at radio frequencies. (8)

Unit - III

3. a) How is the delay line used in vertical section of the oscilloscope. (8)
b) What do you mean of CRO probes. Explain the applications, advantages & disadvantages of CRO probes during measurements. (8)

OR

3. a) Explain the construction and working of free running and triggered mode CRO with neat sketches. (8)
b) What do you mean by CRO probe compensation and how is it adjusted. What effects are considered when the compensation is not adjusted properly. (8)

Unit - IV

4. a) What do you mean by distortion factor. How can distortion factor be measured. (8)
b) What are various uses of a signal generator in an electronic laboratory. Explain how sine wave is generated in a signal generator. (8)

OR

4. Write short notes on the following:-
a) Frequency selective wave analyser (8)
b) Spectrum analyser. (8)

Unit - V

5. a) What are the important features of piezoelectric transducers. Also, explain the charge model of the piezoelectric transducers. (8)
b) Explain the working of resistance wire strain gauge. And obtain an expression for the gauge factor. Give its significance. (8)

OR

5. a) Explain the following characteristics of a transducers:
i) Input
ii) Output
iii) Transfer (8)
b) Explain the working principle and applications of Tachogenerators with suitable examples. (8)

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