NARSIMHA REDDY ENGINEERING COLLEGE
UGC AUTONOMOUS INSTITUTION
Maisammaguda (V), Kompally - 500100, Secunderabad, Telangana State, India
UGC - Autonomous Institute
Accredited by NBA & NAAC with 'A' Grade
Approved by AICTE
Permanently affiliated to JNTUH

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III B.Tech, I Semester, Academic Year: 2024-25

Course Name : Electrical and Electronics Instrumentation (EE3206PE)
L – T – P : 3– 0– 0
Course Instructor : Dr.K.Eswaramoorthy

Time Table

Day/Time	1 09:30 10:20	2 10:20 11:10	3 11:10 12:00	4 12:00 12:50	5 01:40 02:30	6 02:30 03:20	7 03:20 04:00
Monday							
Tuesday							EEI
Wednesday							
Thursday	EEI	EEI					
Friday		EEI					
Saturday			EEI				

SYLLABUS

UNIT–I

Characteristics of Signals and Their Representation: Measuring Systems, Performance Characteristics - Static characteristics, Dynamic Characteristics; Errors in Measurement- Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

Signals and their representation: Standard Test, periodic, aperiodic, modulated signal, sampled data, pulse modulation, and pulse code modulation.

UNIT–II

Oscilloscope and Digital Voltmeters: Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers-CRO probes- applications of CRO- Measurement of phase and frequency - lissajous patterns - Sampling oscilloscope-analog and digital type.

Digital voltmeters-Successive approximation, ramp, dual- Slope integration, continuous balance type - Microprocessor based ramp type DVM, digital frequency meter - digital phase angle meter.

UNIT–III

Signal Analyzers: Wave analyzers - Frequency selective analyzers, Heterodyne, Application of Wave analyzers-Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, spectral displays, vector impedance meter, Q meter. Peak reading and RMS voltmeters.

UNIT–IV

Transducers: Definition of transducers, Classification of transducers, Advantages of electrical transducers, Characteristics and choice of transducers; Principle of operation of resistor, inductor, LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Synchros, Piezoelectric transducers, photovoltaic, photoconductive cells, photo diodes.

UNIT–V

Measurement of Non-Electrical Quantities: Measurement of strain, Gauge sensitivity, Displacement, Force Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Venturimeter: Working Principle.

Text Books:

1. D. V. S Murthy, ―Transducers and Instrumentation, Prentice Hall of India, 2ndedition, 2009.
2. K. Sawhney, ―A course in Electrical and Electronic Measurements and Instrumentation, Dhanpatrai & Co., 12th edition, 2010.

Reference Books:

1. D O Doeblin, ―Measurements Systems, Applications and Design, TMH Publications, 5th edition, 2003.
2. D Helfrick and W. D. Cooper, ―Modern Electronic Instrumentation and Measurement techniques‖, Pearson/Prentice Hall of India, 12th edition, 2010.
3. S Morris, ―Principles of Measurement and Instrumentation, Pearson /Prentice Hall of India, 2nd edition, 1994.
4. H. S. Kalsi, ―Electronic Instrumentation, Tata McGraw-Hill Edition, 1995, 1st edition, 1995.

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UNIT WISE QUESTION BANK

Unit-1

List of Short Questions

S.No	Questions
1.	What are the different type of the errors in the field of instrumentation and measurements?
2.	What is the measurement of the error?
3.	Explain the cause of Gross error?
4.	List the various steps to minimize errors.
5.	What is the accuracy?
6.	What is the Precision?
7.	Explain the difference illustrate it between accuracy and precision.
8.	Define the Accuracy and Precision within Application?
9.	How the different statistical Analysis is Classify?
10.	What are the Different statistical Analysis are occurred in the Measurement of Error?
11.	Explain the cause of Systematic error?
12.	Explain the causes of random error?

List of Long Questions

S.No	Questions
1.	Explain the following by suitable example (i) Gross Errors (ii) Systematic Errors (iii) Random Errors

2.	Define the following terms (i) Average value (ii) Arithmetic mean (iii) Deviation (iv) Standard deviation
3.	Enlist the main static characteristics of instruments. Explain any seven static characteristics.
4.	Explain dynamic characteristics of instruments in detail.
5.	What are the different type of errors in the measurement and how will you minimize these erro
6.	Define the following terms (i) Linearity (ii) Fidelity (iii) Dead zone
7.	Explain the terms accuracy, sensitivity and resolution as under indicating instruments.
8.	Define accuracy, precision, sensitivity, resolution and error with respect to the measurement.
9.	What do you mean by accuracy in instrument? Differentiate it with term Precision.
10.	What is meant by arithmetic mean, average deviation and standard deviation.
11.	Define the following: (a) Accuracy (b) Precision (c) Repeatability (d) Reproducibility (e) Speed of response (f) Response time

Unit-2

List of Short Questions

S.No	Questions
1.	What are the major blocks of the oscilloscope, and what does each do?
2.	What does the term phosphorescence mean?
3.	How is the electron beam focused on to a fine spot on the face of the CRT?
4.	Why are the operating voltages of a CRT arranged so that the deflection plates are nearly at ground potential?
5.	How does the X-shift and Y-shift functions work?
6.	Why is a delay line used in the vertical section of an oscilloscope?
7.	What are the advantages of dual trace over dual-beam CROs for multiple traces?

8.	How does alternate sweep compare with chopped sweep? When would one method be selected over the other?
9.	What is the function of the electronic switch?
10.	How does the sampling CRO increase the apparent frequency response of an oscilloscope?
11.	What are electronics voltmeters? Explain.
12.	What are the advantages of electronics voltmeters?
13.	What are the advantages of true RMS reading voltmeter?
14.	What is the function of a digital voltmeter?
15.	State the advantages of digital voltmeters.
16.	List the applications of digital voltmeters.
17.	What is the function of an electronic analog voltmeter?
18.	Explain the term loading in voltmeter and give methods to remove the adverse effect of loading

List of Long Questions

S.No	Questions
1.	Explain in detail the principle of operation of a single-beam CRO.
2.	Draw the basic block diagram of an oscilloscope and explain the functions of each block.
3.	Derive the expression for acceleration, velocity, and displacement of a charged particle placed in an electric field.
4.	Explain the function of various controls on the front panel of a CRO.
5.	With the help of a circuit diagram, explain the working of a triggered sweep generator.
6.	What is oscilloscope probe compensation, and how is it adjusted? What effects are noted when the compensation is not correctly adjusted?
7.	Explain the use of a CRO for frequency measurement.
8.	What is a delayed sweep CRO? Explain briefly.
9.	Explain the function and explain the working of a 10:1 probe for a CRO.
10.	Describe how the following measurements can be made with the use of a CRO: (i) Frequency (ii) Phase angle.
11.	Discuss in detail the principle of operation of electronics voltmeter with the help of a circuit diagram
12.	Write a short note on true RMS reading voltmeter
13.	Draw a circuit of true RMS meter and explain its working
14.	Explain transistor voltmeter in detail.
15.	Explain rectifier type ac voltmeter.
16.	Describe AC voltmeter using rectifier with a diagram

17.	State the characteristic features of DVMs.
18.	Explain the working of ramp-type DVM.
19.	Draw the block diagram and its working of an integrating type DVM
20.	With the help of a block diagram, describe briefly the working of a successive approximation digital voltmeter.
21.	Enlist the different types of frequency meters. Explain anyone in detail
22.	Draw and explain the basic circuit of a digital frequency meter

Unit-3

List of Short Questions

S.No	Questions
1.	hat is a signal generator? Explain briefly.
2.	assified the signal generators?
3.	hat is a function generator? Explain briefly.
4.	mpare the signal generator and function generator.
5.	rite short notes on: (a) RM makers. b) Digitally programmable test oscillators.
6.	hat is an arbitrary waveform generator?
7.	fine harmonic distortion and give a method for its determination.
8.	hat do you understand by the total harmonic distortion?
9.	plain the harmonic distortion analyser.
10.	hat is the basic principle of the wave analyser?
11.	hat is the significance of a signal analyser?

List of Long Questions

S.No	Questions
1.	Draw the block diagram of an audio frequency and square wave generator and explain its working.
2.	Draw the simple diagram of a pulse generator and explain it briefly.
3.	Explain briefly the following: (a) Sweep generator. (b) Frequency Synthesizer.

4.	Draw the block diagram of the frequency selective wave analyser. How is a complex wave analysed with this analyser?
5.	Explain the operation of a wave analyser and logic analyser.
6.	State the principle of measurement by fundamental suppression analyser. Explain it with a neat block diagram.
7.	Draw and explain the block diagram of a superheterodyne spectrum analyser.
8.	Write a brief note on the accuracy of the network analyser.
9.	With a neat diagram, explain the elements of the network analyser system. Explain each block in detail.
10.	Explain with a neat block diagram the principle of signal analysis using any two signal analyzing instruments.
11.	Describe a harmonic distortion analyser with the help of a block diagram. How does a commercial harmonic distortion analyser differ?
12.	Give the applications of the wave analyser.
13.	Differentiate between a square wave generator and a pulse generator.
14.	Explain the working of the spectrum analyser with the help of a block diagram
15.	Explain the significance of a signal analyser. Describe the principle of operation of a wave analyser.

Unit-4

List of Short Questions

S.No	Questions
1.	What is the definition of a transducer?
2.	How are transducers classified?
3.	What are the advantages of electrical transducers?
4.	Mention the characteristics considered in choosing transducers.
5.	Explain the principle of operation of a resistor transducer.
6.	Describe the principle of operation of an inductor transducer.
7.	How does an LVDT function as a transducer?

8.	What are some applications of LVDTs?
9.	Discuss the principle of operation of a capacitor transducer.
10.	Explain the working of thermocouples as transducers.
11.	What are synchros, and how do they operate as transducers?
12.	Define piezoelectric transducers.
13.	Describe the operation of photovoltaic cells.
14.	What is the function of photoconductive cells?
15.	Explain the working principle of photodiodes.

List of Long Questions

S.No	Questions
1.	Discuss the classification of transducers and provide examples for each type.
2.	Elaborate on the advantages of electrical transducers and provide real-world applications.
3.	Explain in detail the characteristics considered when choosing transducers for specific applications.
4.	Describe the principle of operation of LVDTs and provide examples of their applications.
5.	Provide an in-depth explanation of the working principles and applications of thermocouples.
6.	Explore the operation of synchros as transducers and discuss their significance in control systems.
7.	Discuss the principles of operation and applications of piezoelectric transducers
8.	Explain the working of photovoltaic cells and their applications in converting light energy into electrical energy.
9.	Provide a detailed description of photoconductive cells, their structure, and how they function as transducers.
10.	Elaborate on the working principles and applications of photodiodes as transducers in electronic devices.

Unit-5

List of Short Questions

S.No	Questions
1.	How is strain measured in materials?
2.	Define gauge sensitivity in the context of strain measurement.
3.	Explain how displacement is measured.

4.	What methods are used for measuring force?
5.	How is velocity measured in mechanical systems?
6.	Define angular velocity and discuss its measurement.
7.	Describe the measurement of acceleration in dynamic systems.
8.	Explain the methods for measuring force and torque.
9.	How is temperature measured in industrial processes?
10.	Discuss the measurement of pressure in fluid systems.
11.	What is a vacuum, and how is it measured?
12.	What is the working principle of a Venturimeter?

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List of Long Questions

S.No	Questions
1.	Provide an in-depth explanation of strain measurement techniques and their applications.
2.	Discuss the concept of gauge sensitivity and its importance in strain gauge applications.
3.	Describe various methods for measuring displacement in mechanical systems.
4.	Explain the principles behind force measurement and the devices used for this purpose.
5.	Discuss the measurement techniques for velocity in mechanical systems.
6.	Provide a detailed explanation of the measurement of angular velocity and its applications.
7.	Explain the principles of acceleration measurement in dynamic systems.
8.	Discuss the methods and devices used for measuring force and torque.
9.	Explore the techniques for measuring temperature in industrial processes.
10.	Describe the working principle of pressure measurement devices in fluid systems.
11.	Explain the concept of a vacuum and the methods employed for vacuum measurement.
12.	Provide a detailed explanation of the working principle of a Venturimeter and its applications in fluid flow measurement.