

GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING FOR WOMEN
(Approved by AICTE, New Delhi, Affiliated to JNT University, Kakinada)
Madhurawada, Visakhapatnam – 530048

ACADEMIC PLAN

INSTRUMENTATION

IV Year-I Semester EEE (R13)

Proposed by: Mrs Ch.Sirisha

Department: Electronics & Communication Engineering

SYLLABUS

UNIT —I:

Signals and their representation

10 Hours

Measuring Systems, Performance Characteristics, – Static characteristics – Dynamic Characteristics. (Text 1:1.1 to 1.3,1.7 ; Text 2: 2.1,2.3)

Errors in Measurement – Gross Errors – Systematic Errors – Statistical analysis of random errors. (Text 1:1.4 to 1.6 ; Text 2: 3.5 to 3.8,3.10)

Signal and their representation – Standard test, periodic, aperiodic, modulated signal – Sampled data pulse modulation and pulse code modulation. (Text1:1.9,18.5,18.7)

Questions:

1. Explain about the simple measuring system with the help of block diagram.
2. Explain about the static characteristics of a measuring instrument indicating the sensitivity.
3. Explain about the static hysteresis and dead band characteristics of a measuring instrument.
4. Explain in detail about the dynamic characteristics that indicate the amplitude and frequency variations.
5. Explain about the effect of damping on the settling time by using the dynamic characteristics of a measuring instrument?
6. Discuss in detail about the estimation of systematic errors in the measuring instruments by using an example?
7. Explain in detail about the dead time element response of a measuring instrument in the dynamic characteristics.
8. Derive the equations for the statistical analysis of random errors.
9. Discuss about the complex form representation of a periodic signal.
10. Explain about the pulse code modulation with necessary equations.
11. What are different types of periodic signals draw their characteristics?
12. Explain about the sampling process of a signal by using an example?
13. Explain about the standard test signals with their characteristics.
14. What is meant by modulation? Explain about frequency modulation with necessary equations.

UNIT–II:

Transducers

14 Hours

Definition of transducers – Classification of transducers – Advantages of Electrical transducers – Characteristics and choice of transducers – Principle operation of resistor, inductor, LVDT and capacitor transducers – LVDT Applications – Strain gauge and its principle of operation – Gauge factor – Thermistors – Thermocouples – Synchros – Piezo electric transducers – Photo diodes.(Text 1: 13.1 to 13.20 ; Text 2: Chapter 25; Text: Instrumentation by U.V.Bhakshi : Chapter 8)

Questions:

1. What is meant by a transducer? Write the classification of transducers?
2. Explain about the operation of Thermistors with the help of resistance temperature characteristics?
3. Discuss about hot wire resistance transducers with neat sketch.
4. Discuss about different arrangements for thickness measurement of a magnetic sheet.
5. Explain in detail about the characteristics and choice of transducers?
6. Explain about the inductive displacement transducers?
7. What is meant by strain gauge? Explain its principle of operation.
8. Discuss in detail about Thermistors and thermo couples.

UNIT-III:**Measurement of Non-Electrical Quantities****12 Hours**

Measurement of strain – Gauge Sensitivity – Displacement – Velocity – Angular Velocity – Acceleration – Force – Torque – Measurement of Temperature, Pressure, Vacuum, Flow, Liquid level.(Text 2: Chapter 29; Text: Instrumentation by U.V.Bhakshi : Chapter 8)

Questions:

1. Explain about the importance of flat spiral spring in the torque measurement.
2. Explain about the gauge sensitivity with an example.
3. Discuss about float system by level measurement by neat sketch.
4. Explain about any one method of vacuum measurement.
5. Analyze the torsion bar in the torque measurement by deriving necessary equations.
6. Write the differences between angular velocity and acceleration.
7. Explain about well type manometers with vertical tube and inclined tubes by drawing neat sketches.
8. Describe the flow measurement by static vane elements and rotating vane systems.
9. Explain about the importance of diaphragm elements in the force measurement.
10. Explain how the displacement is measured by using any one method.
11. Draw and explain about the static tube and pilot tube used for the flow measurement.
12. Explain about the principle of operation of fluid expansion systems.
13. Explain how the force can be measured by using helical spiral springs?
14. Explain how the velocity is measured by using any one method.
15. Discuss about the types of bimetallic elements used in the measurement of temperature?
16. Explain about level to pressure converters with neat diagrams.

UNIT-IV:**Digital Voltmeters****10 Hours**

Digital voltmeters – Successive approximation, ramp, dual-Slope integration continuous balance type – Micro processor based ramp type – DVM digital frequency meter – Digital phase angle meter.(Text 1: 5.1 to 5.6; 5.9 and 5.10; 6.1 to 6.4; Text 2: Chapter 28)

Questions:

1. What is meant by voltage doubler circuit? Explain its need in the digital electronic voltmeter.
2. Explain in detail about the digital frequency meter with neat sketch?
3. Explain about volt to time conversion of a digital voltmeter with characteristics.
4. Explain about digital phase angle meter with a neat diagram.
5. Draw the block diagram and explain about the dual slope integrating digital voltmeter?
6. Explain about the micro processor based ramp type digital voltmeter.
7. Draw the block diagram of a successive approximation type digital voltmeter and explain about each block.
8. Discuss in detail about the applications of digital voltmeters.

UNIT–V:

Oscilloscope

12 Hours

Cathode ray oscilloscope – Time base generator – Horizontal and vertical amplifiers – Measurement of phase and frequency – Lissajous patterns – Sampling oscilloscope – Analog and digital type data logger – Transient recorder.(Text 1: 7.1 to 7.7,7.17,7.19,7.20,7.26; Chapter 12; Text 2: Chapter 28)

Questions:

1. Explain about the cathode ray oscilloscope with neat sketch.
2. What is meant by transient recorder and explain its importance.
3. Explain about the measurement of phase and frequency measurement by using lissajous patterns.
4. Write the comparison between analog and digital storage oscilloscope.
5. Explain about the sampling oscilloscope with block diagram and write its advantages.
6. What is meant by horizontal amplifier and how it is used to determine the sensitivity of oscilloscope?
7. Explain about the importance of time base generators in the operation of CRO?
8. What is meant by vertical amplifier and how it is used to determine the sensitivity of oscilloscope?

UNIT–VI:

Signal Analyzers

08 Hours

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.(Text 1: 9.1 to 9.6; 4.17,4.18;10.7; Text 2:Chapter 22,23)

Questions:

1. Explain about the principle of operation of peak reading and RMS voltmeters.
2. Discuss in detail about the types of harmonic distortion analyzers.
3. Explain about the swept receiver spectrum analyzer with the help of block diagram.
4. Explain about the principle of operation of Q meter with neat diagram.
5. Explain about the frequency heterodyne wave analyzer with block diagram.
6. Explain about the principle of operation of vector impedance meter with neat sketch.
7. Explain about the frequency selective wave analyzer with attenuation characteristics.
8. Derive the necessary expressions for the calculation of total harmonic distortion of a wave form.

Text Books:

1. Electronic Instrumentation–by H.S.Kalsi Tata MCGraw–Hill Edition, 1995.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpatrai& Co.

Reference Books:

1. Measurement and Instrumentation theory and application, Alan S.Morris and Reza Langari, Elsevier
2. Measurements Systems, Applications and Design – by D O Doebelin
3. Principles of Measurement and Instrumentation – by A.S Morris, Pearson / Prentice Hall of India
4. Modern Electronic Instrumentation and Measurement techniques – by A.D Helfrickand W.D. Cooper, Pearson/Prentice Hall of India.
5. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India.