Code No: V3209





III B.Tech. II Semester Supplementary Examinations, April/May - 2013 INSTRUMENTATION

(Electrical and Electronics Engineering)

Time: 3 Hours

Max Marks: 80

Answer any FIVE Questions All Questions carry equal marks

- a) Distinguish between the 'static' and 'dynamic' characteristics of a measuring system and state the relevance of each in a measuring process. [8M]
 b) Distinguish between 'error' and 'correction' and show how they are usually expressed for an instrument? [8M]
- a) Explain about analog modulation and digital modulation and clearly mention the situations under which each is preferred. [8M]
 b) Explain the techniques of pulse time modulation and pulse –code modulation and their relative merits. [8M]
- 3. Derive an expression for Deflection sensitivity of an electron beam in a cathode ray oscilloscope. [16M]
- 4. a) Explain with a neat block diagram the working of a ramp type digital voltmeter. [8M]
 b) A 3 ¹/₂ digital voltmeter is used for measuring voltage. (i) Find the resolution of the instrument. (ii) How would the voltage of 14.53 V be displayed on a 10 V scale? (iii) How would be the reading of 14.53 V be displayed on a 100 V scale? [8M]
- 5. Explain with suitable diagrams the working of wave analysers used for audio frequency and mega hertz ranges. [16M]
- 6. a) Explain the following with respect to the transducers:

i) Input characteristics ii) Transfer characteristics iii) Output characteristics [8M] b) A strain gauge is bonded to a beam 0.1 m long and has a cross sectional area 4 cm². Young's modulus for steel is 207 GN/m². The strain gauge has an unstrained resistance of 240 Ω and a gauge factor of 2.2. When a load is applied, the resistance of gauge changes by 0.013 Ω . Calculate the change in length of steel beam and the amount of force applied to the beam. [8M]

7. a) Why are dummy gauges used? In what way do they effect the output of a strain gauge bridge? [8M]

b) A single strain gauge is mounted to measure the axial strain in a simple tensile member. If the recorded strain is 380 microstrain, what is the axial stress:

(i) If the member is of steel?

(ii) If the member is of aluminum?

The modulus of elasticity of steel is 200 GN/m^2 and that of aluminum is 70 GN/m^2 . [8M]

8. Write short notes on the following:
(i) Lissajous patterns with respect to CRO
(ii) Photo diodes
[16M]

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- a) Explain the types of test signals used for determination of dynamic characteristics. [8M]
 b) Define 'Repeatability' and 'Reproducibility' and explain why transducers and instruments should possess these characteristics. [8M]
- a) Define Bandwidth of a signal and explain the way signals are classified according to their bandwidth. [8M]
 b) What are the differences between sampling process and pulse modulation? [8M]
- 3. Explain with a neat diagram, the principle of working of a digital storage oscilloscope.
- [16M] a) Explain the working of an integrating type digital voltmeter with a neat diagram. 4. b) A certain $3\frac{1}{2}$ digit DVM has an accuracy specifications of ± 0.5 percent of reading ± 2 digits. (i) What is the possible error, in volt, when the instrument is reading 5.00 V on its 10 V range? (ii) What is the possible error in volt, when the reading 0.10 on the 10 V range? [8M+8M] Explain the term "Total harmonic distortion". Describe the functioning of a total harmonic 5. distortion meter. [16M] a) Explain the following with reference to the transducers 6. (iii) Non-conformity error (i) Zero error (ii) Sensitivity error (v) Dynamic error (iv) Hysteresis error [10M] b) List the advantages of LVDT [6M] 7. a) Explain the importance of load cells. [8M] b) Explain the method of measurement of differential pressure using an inductive transducer. [8M]
- 8. Write short notes on the following:
 [16M]

 a) RMS Voltmeters
 b) Peak reading voltmeter
 [16M]

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- 1. a) Explain the terms time constant and settling time of an instrument and indicate the factors responsible for them. [8M] b) Explain how the non linearity of a measuring system is defined and estimated. [8M] 2. Derive the expression for a frequency modulated signal and show how the number of sidebands increases with modulation index? [16M] 3. a) Explain the functioning of a time base generator in a CRO. [8M] b) Calculate the velocity of the electron beam in an oscilloscope if the voltage applied to its vertical deflection plates is 2000 V. Also calculate the cutoff frequency if the maximum transit time is ¹/₄ of a cycle. The length of horizontal plates is 50mm. [8M] 4. Explain with the help of suitable circuit diagrams, how the following types of measurements are carried out using a digital frequency meter? (i) Single and multiple period measurements (ii) Time interval measurements (iii) Multiple ratio measurements. [16M]
- 5. Describe the basic circuit of a spectrum analyser. Explain how the spectra of the following is displayed:
 - (i)Continuous wave signals(ii)Amplitude modulated signals
 - (iii)Frequency modulated signals
 - (iv) pulse modulated signals

[16M]

[16M]

[16M]

- 6. a) Explain the construction of wire wound strain gauges and derive the expression for the gauge factor. [8M]
 b) List the properties of materials used for piezo-electric transducers. [8M]
- 7. Explain the following methods used for measurement of low pressures using:
 - (i) Thermocouple vacuum gauge,
 - (ii) Pirani Gauge,
 - (iii) Ionization type vacuum gauge.
- 8. Write short notes on the following:
 - (i)Toothed rotor variable reluctance Tachometer
 - (ii) Photo electric Tachometer.

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[8M]

Answer any FIVE Questions

All Questions carry equal marks

- a) Distinguish between 'systematic ' and 'random ' errors in a measurement and how they are usually minimized. [8M]
 b) Define drift, threshold value and dead-band of a measuring system and give an example for each. [8M]
- 2. a) Distinguish between periodic and aperiodic signals and give examples for each. [8M]b) Explain phase and frequency modulation, defining the modulation index for each case.
- 3. Explain the following types of oscilloscopes (i) Dual trace type (ii) dual beam type [16M]

4. Explain the following terms as applied to digital displays: (i) Resolution (ii) Difference between 3 ¹/₂ digit and 4 digit displays (iii) Sensitivity of digital meters (iv) Accuracy specifications of digital meters. [16M]

- 5. Explain how Q- factor of a coil can be measured using a bridge T network? Derive the expression for Q. [16M]
- 6. Explain the working and construction of resistance thermometers. Describe the materials used for RTDs, along with their properties .Sketch their typical characteristics. [16M]
- 7. Explain the different electrical methods for measurement of Liquid level. Compare their advantages and disadvantages. [16M]
- 8. Write short notes on the following:
 (i) Thermistors
 (ii) Thermo couple Vacuum gauge. [16M]

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