

III B.Tech. II Semester Regular Examinations, April/May -2005**INSTRUMENTATION****(Electrical & Electronic Engineering)****Time: 3 hours****Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is meant by stability of a measuring system? Indicate which class of instruments are required to be more stable.
(b) Explain how the non linearity of a measuring system is defined and estimated.
2. Explain the types of test signals used for determination of dynamic characteristics.
3. How does alternate sweep compared with chopped sweep? When would one method be chosen over the other.
4. (a) With a neat block diagram explain the potentiometric type digital voltmeter.
(b) The lowest range on a 4 1/2 digit digital voltmeter is 10mv full scale. What is the sensitivity of this meter
5. (a) Discuss in detail about the principle of operation of a capacitive transducer?
(b) What is the relation between sensitivity and area of plates?
6. Explain the principle of thermistor ? And state the applications?
7. (a) What is the gauge sensitivity? Explain with a neat sketch to find the sensitivity of a half bridge.
(b) Two electrical strain gauges are bonded to a duralumin cantilever and connected a bridge as adjacent arms. Each gauge has a resistance of 100Ω and a gauge factor of 2.1. the input voltage is 4V. The stress is $200MN/m^2$. Find the current through the detector if its resistance is 400Ω . Modulus of elasticity of duralumin is $70GN/m^2$.
8. (a) Describe the construction and working of LVDT accelerometer with a neat sketch
(b) An LVDT is used in an accelerometer to measure seismic mass displacement. The LVDT and signal conditioning outputs are $0.31mv/mm$ with a $\pm 20mm$ core displacement. The spring constant is $240N/m$ and the core mass is $0.05kg$. Find
 - i. relation between acceleration in m/s^2 and the output voltage
 - ii. natural frequency and
 - iii. maximum acceleration measurable

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1. Draw the block diagram of the measuring system and explain the each stage with their functions.
2. Define band width of a signal and explain the way signals are classified according to their band width.
3. (a) What do you mean by multi trace with respect to oscilloscopes
(b) With a neat block diagram explain the each block of a dual-trace oscilloscope
4. Explain with a neat block diagram for time interval measurement and explain each block and its functionalities.
5. (a) Discuss in detail about the principle of operation of a capacitive transducer?
(b) What is the relation between sensitivity and area of plates?
6. (a) What are the advantages and disadvantages of a capacitive transducer?
(b) A barium titanate pick up has the dimensions of 5mmx5mmx1.25mm. The force acting on it is 5N. The charge sensitivity of barium titanate is 150 PC/N and its permittivity is 12.5×10^{-9} F/M. The force acting on it is 5N. If the modulus of elasticity of barium titanate is 12×10^6 N/M². Calculate the strain, the charge and the capacitance
7. Explain the measurement of pressure using piezo-electric transducer
8. (a) Describe the construction and working of LVDT accelerometer with a neat sketch
(b) An LVDT is used in an accelerometer to measure seismic mass displacement. The LVDT and signal conditioning outputs are 0.31mv/mm with a ± 20 mm core displacement. The spring constant is 240N/m and the core mass is 0.05kg. Find
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1. (a) Define passive and active transducers and give an example of each.
(b) Distinguish between static and dynamic characteristics of an instrument.
2. Describe the process of obtaining discrete time signal from continuous time signal.
Draw the necessary plots.
3. Explain with a neat block diagram of a horizontal deflection system.
4. With a neat block diagram, explain each block of a heterodyne wave analyzer.
5. (a) Discuss in detail about the principle of operation of a capacitive transducer?
(b) What is the relation between sensitivity and area of plates?
6. (a) Explain in detail about photo diode and photo transistors?
(b) Explain in detail about thermocouples?
7. (a) A round steel bar of .03mm in diameter is .5m long and is subjected to a tensile force of 40kg where $E = 3 \times 10^6 \text{ kg/m}^2$. Find the elongation in meters
(b) Write short notes on strain gauges and their applications
8. (a) Explain the measurement of torque of rotating shaft using multi toothed wheel
(b) A digital meter is used to determine the torque in a rotating shaft using single toothed flanges and inductive pickups. Static calibration show that the flange twist by an angle of one degree for an applied torque of 1000Nm. In a test with the shaft rotating at 500rpm, the torque calculated from the timer readings is 1200Nm. What is the maximum possible error of final digit on the timer display represents units of 10^{-5} s , and accuracy of instrument specified 0.05% of the reading ± 1 in the final digit.

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1. Draw the block diagram of the measuring system and explain the each stage with their functions.
2. Distinguish between analog modulation and digital modulation and explain the situations under which each is preferred.
3. (a) An electro statically deflected cathode ray tube has plane parallel deflecting plates which are 2.5cm long and 0.5cm apart, and the distance from their centre to the screen is 20cm. The electron beam is accelerated by a potential difference of 2500v and is projected centrally between the plates. Calculate the deflecting voltage required to cause the beam to strike a deflecting voltage and find the corresponding deflection of the screen.
(b) What is the relationship between the period of a waveform and its frequency? How is an oscilloscope used to determine frequency?
4. What do you mean by harmonic distortion and explain anyone method for measuring it.
5. (a) Explain the method of measurement of linear displacement using potentiometer
(b) A heliport is provided with 40 turns/mm. The gearing arrangement is such that the motion of the main shaft by one revolution causes 5 revolutions of the potentiometer shaft. Calculate the resolution of the Potentiometer?
6. Explain the principle of thermistor ? And state the applications?
7. (a) What is a full bridge. Derive an expression for gauge sensitivity of a full bridge.
(b) A bridge circuit has two fixed resistances and two strain gauges all of which have a value of 1200Ω . The gauge factor is 2.04 and the strain applied to twin strain gauges one in tension and the other in compression is 0.000165. if the battery current in the initial balanced condition of the bridge is 50mA determine.
 - i. voltage o/p of the bridge
 - ii. The sensitivity in volt per unit strain
8. What is the principle of ultrasonic flow meter. Explain the operation of ultrasonic flow meter with neat sketch.
