

IV B.Tech. II Semester Supplementary Examinations, July -2005**INSTRUMENTATION****(Electrical & Electronic Engineering)****Time: 3 hours****Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Explain the following with suitable examples:
 - (a) Transducer
 - (b) Inverse transducer
 - (c) Output transducer
2.
 - (a) Derive the expression for time response of first order system subjected to step input.
 - (b) A RC circuit consists of a capacitor of $1\mu\text{F}$ in series with a resistor of $1\text{k}\Omega$. A dc voltage of 50V is suddenly applied across the circuit. Calculate the value of voltage after 10 mSecs .
3.
 - (a) Explain the functioning of a ramp type digital voltmeter.
 - (b) Gating periods of 1 ms , 10 ms , 100 ms , 1 s and 10 s are provided on a digital counter-time-frequency meter having a 4 digit display. When a gating period is used a reading of 0095 is obtained. What is the likely value of frequency? What steps should be taken to obtain most accurate result?
4.
 - (a) Describe the basic circuit of spectrum Analyzer.
 - (b) Explain how the spectrum of the following is displayed.
 - i. continuous wave s/l
 - ii. AM signal
 - iii. FM
 - iv. Pulse modulates signal.
5.
 - (a) What are the advantages and disadvantages of a capacitive transducer?
 - (b) A barium titanate pick up has the dimensions of $5\text{mm} \times 5\text{mm} \times 1.25\text{mm}$. The force acting on it is 5N . The charge sensitivity of barium titanate is 150 PC/N and its permittivity is $12.5 \times 10^{-9}\text{ F/M}$. The force acting on it is 5N . If the modulus of elasticity of barium titanate is $12 \times 10^6\text{ N/M}^2$. Calculate the strain, the charge and the capacitance.
6.
 - (a) What are the applications of LVDT?
 - (b) A steel cantilever is 0.25mm long, 20mm wide and 4mm thick.

- i. Calculate the value of deflection at the free end for the cantilever when a force of 25N is applied at the end. The modulus of elasticity for steel is $200 \text{ GN}/\text{M}^2$. An LVDT with a sensitivity of $0.5\text{v}/\text{mm}$ is used. The voltage is read on a 10V voltmeter having 100 divisions. Two tenths of a division can be read with certainty
 - ii. Calculate the minimum and maximum value of force that can be measured with this arrangement?
7. (a) Discuss the principle of operation of strain gauge. What is gauge factor? Compare some of the important characteristics of metallic and semiconductor type strain gauges.
(b) A resistive strain gauge with a gauge factor of 2 is fastened to a member which is subjected to a strain of 1×10^{-6} . If the original value of gauges is 130 ohms, calculate change in resistance.
8. (a) Compare the advantages and disadvantages of dc tachometer generation and ac tachometer generator.
(b) A variable reluctance type tachometer has 60 rotor teeth. The counter records 3600 counts per second. Determine the speed in rpm.

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1. (a) i. Describe the international standard of mass and length.
ii. What are atomic standards for frequency and time?
(b) What are different standard test signals for studying the dynamic response of a system? Explain them with suitable sketches.
2. Briefly explain the following systems with examples.
 - (a) Underdamped system
 - (b) Overdamped system
 - (c) Critically damped system.
3. (a) Describe the working of an integrating type voltmeter.
(b) A $4\frac{1}{2}$ digit voltmeter is used for voltage measurements.
 - i. Find its resolution.
 - ii. How would 12.98 V be displayed on 10V range?
 - iii. How would 0.6973 be displayed on 1 V range?
 - iv. How would 0.6973 be displayed on 10 V range?
4. Explain in detail about spectrum Analyzers used for High frequency.
5. (a) What are the primary detectors? Explain in detail?
(b) A torque bar of 30 mm diameter is used for measurement of a torque of 100 NM. Calculate the angle of twist if shear modulus of mild steel is $80 \times 10^9 \text{ N}/\text{M}^2$
6. (a) Discuss in detail the operation of LVDT?
(b) What are the advantages and disadvantages of LVDT?
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 $200 \text{ MN}/\text{m}^2$. Find the current through the detector if its resistance is 400Ω . Modulus of elasticity of duralumin is $70 \text{ GN}/\text{m}^2$.

8. (a) Compare the advantages and disadvantages of dc tachometer generation and ac tachometer generator.
- (b) A variable reluctance type tachometer has 60 rotor teeth. The counter records 3600 counts per second. Determine the speed in rpm.

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1. (a) Briefly explain the following transducer errors.
 - i. Zero error
 - ii. Sensitivity error
 - iii. Non-conformity error
 - iv. Hysteresis error
- (b) Briefly explain the classification of transducer based on the principle of transduction.
2. (a) Derive the expression for time response of first order system subjected to step input.
- (b) A RC circuit consists of a capacitor of $1\mu\text{F}$ in series with a resistor of $1\text{k}\Omega$. A dc voltage of 50V is suddenly applied across the circuit. Calculate the value of voltage after 10 mSecs .
3. (a) A $3\frac{1}{2}$ digit voltmeter is used for measuring voltage.
 - i. Find its resolution.
 - ii. How would a voltage of 14.53 V be displayed on 10V range?
 - iii. How would a reading of 14.53 V be displaced on 100V range?
- (b) Draw and explain the block diagram of storage oscilloscope.
4. Explain the different methods used for measurement of RMS values of Voltages.
5. (a) What are the advantages and disadvantages of a capacitive transducer?
- (b) A barium titanate pick up has the dimensions of $5\text{mm} \times 5\text{mm} \times 1.25\text{mm}$. The force acting on it is 5N . The charge sensitivity of barium titanate is 150 PC/N and its permittivity is $12.5 \times 10^{-9}\text{ F/M}$. The force acting on it is 5N . If the modulus of elasticity of barium titanate is $12 \times 10^6\text{ N/M}^2$. Calculate the strain, the charge and the capacitance.
6. (a) Explain the operation of a thermocouple for the measurement of temperature?
- (b) Explain in detail about photo voltaic and photo conductive cells?
7. (a) Discuss the list of various transducers that can be used as secondary transducers in pressure measurement.
- (b) Explain the pressure measurement using resistive transducers.

8. (a) Explain in general, the measurement of torque using digital technique compare the merits of multi toothed flange over single toothed flange. Give the necessary sketch
- (b) Explain the measurement of torque using strain gauge torque method. Also give the advantages of this method.

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3.
 - (a) What are the different types of digital voltmeters? Explain each of them briefly.
 - (b) The lowest range on a $4\frac{1}{2}$ digit DVM is 10 mV full scales. What is sensitivity of this meter?
4. With a neat sketch explain the operation of RF vector Impedance meter.
5.
 - (a) What are the primary detectors? Explain in detail?
 - (b) A torque bar of 30 mm diameter is used for measurement of a torque of 100 NM . Calculate the angle of twist if shear modulus of mild steel is $80 \times 10^9\text{ N/M}^2$
6.
 - (a) Explain in detail about photo diode and photo transistors?
 - (b) Explain in detail about thermocouples?
7.
 - (a) What is a load cell. Explain the working of a load cell strain gauge bridge.
 - (b) A load cell consists of a solid cylinder of steel 40mm in diameter with four strain gauges bonded to it and connected in to the four arms of a voltage sensitive bridge. The gauges are mounted to have Poissons arrangement. The gauge factor is 2.1 and each gauge has 1000 ohms resistance. The bridge excitation voltage is 6v . Determine the sensitivity of the cell in V/KN modules of elastic for steel is 200GN/m^2 and Poisson ratio is 0.29 .
8.
 - (a) What is dynamic compensation? Explain the compensation adjustment scheme in a hot wire anemometer using square wave current source.

- (b) Explain how torque can be measured using an inductive transducer. Give the sketch for arrangement of inductive transducers with respect to shaft.

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