

**III B.Tech II Semester Supplementary Examinations,
November/December 2005
INSTRUMENTATION**

(Electrical & Electronic Engineering)

Time: 3 hours**Max Marks: 80**

**Answer any FIVE Questions
All Questions carry equal marks**

1. (a) Define Instrumentation and the importance of the Instrumentation systems. [5]
(b) Explain the role of electronic circuits in the field of modern Instrumentation. [5]
(c) Distinguish a meter from an instrument and state the primary role of each. [6]
2. Distinguish between phase and frequency modulation, defining the modulation index for each case. [16]
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. [8]
(b) What is the relationship between the period of a waveform and its frequency? How is an oscilloscope used to determine frequency? [8]
4. (a) Explain with an appropriate circuit for measurement of low impedance component with respect to Q-meter [8]
(b) For measuring small values of capacitance, a 60 MHZ signal source is to be used in a capacitance meter. What value of series resistance is required if the phase shift is to be kept below 5.7 degrees for full scale capacitance readings of 1, 10 and 100 PF. [8]
5. (a) A resistive position transducer with a resistance of 5 k Ω and a shaft stroke of 8 cm is applied with a voltage of 5V. When the wiper is 3cm from the Reference, what is the value of the output voltage? [8]
(b) A resistance strain gauge with a gauge factor 2.04 is fastened to a beam which is subjected to a strain of 1×10^{-6} . If the original resistance of the gauge is 120 Ω calculate the change in resistance? [8]
6. (a) Discuss specifications of LVDT ? [8]
(b) A copper constantan thermocouple with “ = $3.75 \times 10^2 \text{mv/oc}$ and % = $4.5 \times 10^{-5} \text{mv/oc}$. If $T_1 = 100 \text{ oc}$ and the cold junction T_2 is kept in ice compute the resulting emf? [8]

7. (a) What is a strain gauge ? Explain the construction of different types of strain gauges with neat sketches. [8]
- (b) Explain in general how pressure is measured with electrical transducer as secondary transducers. [8]
8. (a) Compare the advantages and disadvantages of dc tachometer generation and ac tachometer generator. [8]
- (b) A variable reluctance type tachometer has 60 rotor teeth. The counter records 3600 counts per second. Determine the speed in rpm. [8]

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1. Draw the block diagram of the measuring system and explain the each stage with their functions. [16]
2. What are side bands of a modulated signal and explain their presence in the AM and FM signals. [16]
3. (a) How does the digital storage oscilloscope differ from the conventional storage oscilloscope using a storage cathode ray tube. [10]
(b) List the advantages of each [6]
4. Explain different methods used for measurement of unknown components using Q-meter. [16]
5. (a) What are the various types of inductive transducers? [8]
(b) Explain in detail the working of inductive transducers operating on the principle of eddy currents? [8]
6. (a) What are the applications of LVDT? [8]
(b) A steel cantilever is 0.25mm long, 20mm wide and 4mm thick [8]
 - 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) Explain the principle of thermo couple vacuum gauge. [8]
(b) Explain the measurement of vacuum using pirani gauge. [8]
8. What is the principle of ultrasonic flow meter. Explain the operation of ultrasonic flow meter with neat sketch. [16]

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1. (a) Define passive and active transducers and give an example of each. [8]
(b) Distinguish between static and dynamic characteristics of an instrument. [8]
2. Distinguish between phase and frequency modulation, defining the modulation index for each case. [16]
3. (a) Write short notes on post deflection acceleration with respect to oscilloscope tube [8]
(b) What is the minimum distance, L , that will allow full deflection of 4cm at the oscilloscope screen with a deflection factor of 100v/cm and with an accelerating potential of 2000v. [8]
4. What do you mean by harmonic distortion and explain anyone method for measuring it. [16]
5. (a) A resistive position transducer with a resistance of 5 k Ω and a shaft stroke of 8 cm is applied with a voltage of 5V. When the wiper is 3cm from the Reference, what is the value of the output voltage? [8]
(b) A resistance strain gauge with a gauge factor 2.04 is fastened to a beam which is subjected to a strain of 1×10^{-6} . If the original resistance of the gauge is 120 Ω calculate the change in resistance? [8]
6. An LVDT with a secondary voltage of 5.2v has a range of ± 1.5 cm determine [16]
(a) the output voltage when the core is 1.0 cm from center
(b) the plot of output vs core position for a core movement going from .8cm to -.1cm
7. (a) Explain the method of adjacent arm compensating gauge for temperature compensation in strain gauge with a neat circuit. [8]
(b) A single electrical resistance strain gauge of resistance 120 Ω and having a gauge factor of 2 is bonded to steel having an elastic limit stress of 400MN/ m^2 and modulus of elasticity 200 GN/ m^2 . calculate the change in resistance due to a change of temperature of 20 $^{\circ}$ C co-efficient of linear expansion of steel is $12 \times 10^{-6}/^{\circ}$ C. [8]
8. (a) Explain the principle of hot wire anemometer for the flow measurement. [8]

- (b) Explain the flow-direction measurement using hot wire anemometer. Give a neat sketch. [8]

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1. Draw the block diagram of the measuring system and explain the each stage with their functions. [16]
2. (a) Define Laplace and Fourier transforms and indicate the conditions under which each is applicable. [8]
(b) Derive from fundamentals the expression representing a rectangular pulse train by Fourier series. [8]
3. With a neat block diagram explain the ramp type digital voltmeter. [16]
4. Explain with a neat circuit diagram of a peak reading voltmeter. [16]
5. (a) What are the various types of inductive transducers? [8]
(b) Explain in detail the working of inductive transducers operating on the principle of eddy currents? [8]
6. (a) Explain the operation of a thermocouple for the measurement of temperature? [8]
(b) Explain in detail about photo voltaic and photo conductive cells? [8]
7. (a) Explain the working of a oscillation transducer in the measurement of pressure. [8]
(b) A strain gauge of nominal resistance 200Ω is fixed on one flat surface of a short column of 2cm X 2cm cross sectional area. The column is subjected to an axial force of 100N. the strain gauge forms one arm of a bridge with other arms all equal to 200Ω . Find open circuit voltage of the bridge excited by 10v. Given youngs modulus of elastic is $2.1 \times 10^{11} \text{N/m}^2$. [8]
8. (a) Compare the advantages and disadvantages of dc tachometer generation and ac tachometer generator. [8]
(b) A variable reluctance type tachometer has 60 rotor teeth. The counter records 3600 counts per second. Determine the speed in rpm. [8]
