

**III B.Tech. I Semester Regular Examinations, November -2005**  
**INDUSTRIAL INSTRUMENTATION**  
**(Electronics & Instrumentation Engineering)**

**Time: 3 hours**

**Max Marks: 80**

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

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1. (a) Write in detail about fluid displacement comparators  
(b) Discuss the construction and working principle of differential comparators. [8+8]
2. Discuss briefly about the principle and specifications of the different practical Accelerometers. [16]
3. Describe the basic principle of different Mechanical Tachometers [16]
4. (a) Draw the sketch and explain the working of hydraulic load cell.  
(b) What is the principle of Force- balance device? [8+8]
5. (a) Draw the sketch and explain the principle of Generalized II order system, representing a vibration pick-up transducer.  
(b) Describe the principle and working of electromagnetic transducer. [8+8]
6. What is vibrating U-tube density sensor? Briefly explain about vibrating single tube fluid density sensor. [16]
7. Explain the different methods of measuring consistency along with their usage. [16]
8. (a) Explain how resistive transducers can be used for measurement and control of relative humidity. Describe its advantages and disadvantages.  
(b) Describe the theory and working of a sling psychrometer used for the measurement of relative humidity. What are its limitations? [8+8]

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1. (a) Explain four balls method for measuring diameter of bore.  
(b) Discuss about small bore diameter measurement by a ball on a wire. [8+8]
2. (a) Calculate the frequency ratio for which the error in acceleration is 1% if the damping factor is 0.7.  
(b) A Seismic Accelerometer sensing displacement has an undamped frequency of 20Hz and a damping ratio 0.7. Calculate
  - i. Its damped frequency
  - ii. The amplitude ratio and phase angle between the motion of the seismic mass and the applied vibration, if the later is a sinusoidal displacement at a frequency of 30 Hz. [8+8]
3. (a) The speed of a shaft rotating at 2800 rpm is measured using a stroboscope. The stroboscope dial is slowly turned from setting of 4320 rpm to 1400 rpm corresponding to flash rate of 96 to 24 per second.
  - i. Indicate the speed settings which give single, double and triple steady images
  - ii. what is the observation when the flashing rate is 50 per second.  
(b) In order to measure a speed higher than flashing rate of stroboscope, the flashing rate was gradually reduced from the highest, noting all the speeds at which single image is observed of a mark on the rotating object. These speeds are 20000, 15000, 12000 and 10000 rpm, calculate the actual speed. [8+8]
4. Explain the measurement of force using transducers
  - (a) L.V.D.T
  - (b) Piezoelectric transducer [8+8]
5. (a) What are the advantages of Piezoelectric pickups for vibrations measurements? What are the materials exhibiting this effect?  
(b) Draw the circuit for charge generator model of the Accelerometer with cable and derive the expression for the transfer function . [8+8]
6. What is vibrating U-tube density sensor? Briefly explain about vibrating single tube fluid density sensor. [16]
7. Explain the different methods of measuring consistency along with their usage. [16]

8. (a) Explain the importance of humidity measurement in industry.
- (b) Name some processes which might require humidity control for efficiency operation. [8+8]

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1. (a) What are the advantage of differential type pneumatic comparators?  
(b) Define the following terms in connection with pneumatic comparators
  - i. Overall management or sensitivity of the system
  - ii. Measuring head sensitivity
  - iii. pneumatic sensitivity
  - iv. Indicator sensitivityHow does each get affected? [8+8]
2. (a) Calculate the frequency ratio for which the error in acceleration is 1% if the damping factor is 0.7.  
(b) A Seismic Accelerometer sensing displacement has an undamped frequency of 20Hz and a damping ratio 0.7. Calculate
  - i. Its damped frequency
  - ii. The amplitude ratio and phase angle between the motion of the seismic mass and the applied vibration, if the later is a sinusoidal displacement at a frequency of 30 Hz. [8+8]
3. (a) Suggest one method to measure the rotational speeds upto 5000 r/min at an accuracy of  $\pm 1/2$ .  
(b) Discuss the principle of tachogenerators. [8+8]
4. A quartz crystal has the dimensions of 2mmx2mmx1mm. Quartz has the following properties charge sensitivity= $21\text{C/N}$ . Young's modulus=  $8.6 \times 10^{10}\text{N/m}^2$  Permittivity =  $40.6 \times 10^{-12}\text{F/m}$ . Calculate the value of force, charge, and voltage if the crystal is subjected to a strain of  $10 \times 10^{-6}\text{m/m}$ . [16]
5. (a) Draw the sketch and explain the principle of Generalized II order system, representing a vibration pick-up transducer.  
(b) Describe the principle and working of electromagnetic transducer. [8+8]
6. What is vibrating cylinder sensor? Explain briefly about vibrating twin tube sensor and give its applications. [16]
7. Explain the different methods of measuring consistency along with their usage. [16]
8. (a) Explain the importance of humidity measurement in industry.

- (b) Name some processes which might require humidity control for efficiency operation. [8+8]

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1. Mention different Electrical and Electronic comparators and explain the same in detail. [16]
2. (a) Calculate the frequency ratio for which the error in acceleration is 1% if the damping factor is 0.7.  
(b) A Seismic Accelerometer sensing displacement has an undamped frequency of 20Hz and a damping ratio 0.7. Calculate
  - i. Its damped frequency
  - ii. The amplitude ratio and phase angle between the motion of the seismic mass and the applied vibration, if the later is a sinusoidal displacement at a frequency of 30 Hz. [8+8]
3. (a) Mention the devices used for measuring speed.  
(b) Give its classification.  
(c) Explain the basic principle of the simplest type mechanical tachometer.  
(d) Explain the concept of measurement of speed by means of centrifugal force. [16]
4. Explain the principle and working of the following Deflection type torque measuring instruments
  - (a) mechanical torque measuring type
  - (b) electric torque measuring type
  - (c) electronic techniques [5+5+6]
5. (a) Draw the sketch and explain the principle of Generalized II order system, representing a vibration pick-up transducer.  
(b) Describe the principle and working of electromagnetic transducer. [8+8]
6. (a) Explain with a neat diagram the radiation type of measuring density.  
(b) Explain briefly about specific gravity scales generally used in the petroleum industries. [8+8]
7. (a) List some devices for measuring viscosity in laboratory and industry. Explain any one of them.  
(b) Explain velocity gradient for viscosity liquids by way of a velocity profile curve

[8+8]

8. (a) Explain specific humidity, DBT, WBT.  
(b) Explain about Galvanometric Hygrometer.

[8+8]

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