

Code No: M0323/R07

Set No. 1

**IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
INSTRUMENTATION AND CONTROL SYSTEMS**

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 hours

Max Marks: 80

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

1. Explain the dynamic response characteristics of first order instruments to step, ramp and sinusoidal inputs. [16]
2. (a) List electrical transducers for measurement of linear and angular displacement.
(b) Explain by means of neat sketches how wire wound and carbon film potentiometers can be used for measurement of linear and angular displacement. [4+12]
3. (a) Explain the terms
 - i. Absolute pressure
 - ii. Gauge pressure
 - iii. Differential pressure
 (b) Describe the construction, working and theory of a McLeod gauge for measurement of vacuum. List their advantages and disadvantages. [3 × 2 = 6 + 10]
4. Explain the construction, working and applications of the following types of flow Meters:
 - (a) Magnetic flow meter
 - (b) Turbine flow meter. [8+8]
5. (a) Explain the principle of seismic instrument. Derive an expression to measure velocity and acceleration using this instrument.
(b) What are the advantages and disadvantages of centrifugal speed tachometer? [10+6]
6. (a) List a few bonding adhesives used for bonding strain gauges to the test surface.
(b) Name the various types of strain gauges for different applications.
(c) An electric resistance strain gauge of 100 Ω resistance and gauge factor 2 is bonded to a specimen of steel. Calculate the change in resistance of the gauge when a tensile stress of 60MN/m² is applied on the specimen. [4+6+6]
7. Explain the constructional and working of the following:
 - (a) Rope brake
 - (b) Prony brake
 - (c) Fluid Brake [6+5+5]

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8. (a) Briefly explain the different types of control systems.
(b) Describe the working of one automatic control system used in practice. Outline functional elements of that system. [6+10]

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Set No. 2

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1. Explain the static calibration procedure for measurement systems over their working range. What is the necessity for static calibration? How is the calibration curve useful? How are bias and impression eliminated? [16]
2. (a) What are pyrometers? Indicate their working principles.
 (b) By means of neat sketches, explain the working of linear variable differential transformer (LVDT). [6+10]
3. (a) Describe the construction, working and theory of a Bridgman gauge for measurement of high pressures.
 (b) Briefly explain the principle employed in manometers used for the measurement of pressure. [10+6]
4. With neat sketch describe the principle of operation, construction, advantages and limitations of Rotameter. [16]
5. Explain with neat sketches the working of Mechanical Tachometers. [16]
6. (a) What is a bonded strain gauge?
 (b) List the main advantages and limitations of semiconductor strain gauges.
 (c) Explain one method of temperature compensation using an adjacent arm compensating gauge. [2+6+8]
7. (a) Explain how Spring balances can be used for measurement of force. Describe their working ,advantages and limitations.
 (b) Define the Psychometric terms:
 - i. Relative humidity
 - ii. Dew point temperature
 - iii. Wet bulb temperature. [10+6]
8. (a) Describe with neat sketch the open loop speed control system.
 (b) Illustrate with example, explain Closed loop temperature control system. [8+8]

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1. Explain the dynamic response characteristics of first order instruments to step, ramp and sinusoidal inputs. [16]
2. (a) Differentiate between rare metal thermocouples and base metal thermocouples.
 (b) Design a measurement system for displacement measurement using LDR (Light dependent resistor) as sensor. [6+10]
3. (a) Explain the measurement of pressure using U-tube manometer.
 (b) Discuss the constructional features of Bourdon-tube pressure gauge. [8+8]
4. (a) Explain the working principle of Capacitance liquid level sensor.
 (b) Describe the working of a cryogenic fuel level indicator. What are its advantages and limitations? [6+10]
5. Describe the following:
 - (a) Working principle of Centrifugal speed tachometer
 - (b) Working principle of Vibration reed tachometer
 - (c) Revolution counter. [6+6+4]
6. (a) Briefly discuss on the surface preparation and bonding techniques for mounting bonded strain gauges.
 (b) Differentiate the n-type and p-type sensing elements of a semiconductor strain gauge.
 (c) List the advantages and limitations of unbonded strain gauges. [8+4+4]
7. (a) What are the various devices to measure force? Explain the constructional details of multi lever type.
 (b) With neat sketch explain the working principle of Strain gauge load cell. [10+6]
8. (a) Define the terms:
 - i. Block
 - ii. Summing point
 - iii. Branch Point
 (b) Mention the application of automatic control devices in industries

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(c) What are the limitations of open loop systems.

[6+6+4]

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1. Explain the dynamic response characteristics of first order instruments to step, ramp and sinusoidal inputs. [16]
2. (a) Classify inductive transducers.
 (b) Explain the working of LVDT by means of neat sketches. [4+12]
3. (a) Name a few applications of pressure measurement.
 (b) What is the difference between atmospheric pressure and absolute pressure?
 (c) Illustrate, pressure classification with suitable examples. [2+4+10]
4. (a) Explain how Doppler effect is used for measurement of flow velocities in ultrasonic flow meters.
 (b) Explain the working principle of Bubbler gauge. [8+8]
5. What is a seismic type velocity transducer? Explain its construction with the help of a neat diagram. How can it be used for measurement of acceleration in vibration measurements? Explain. [16]
6. (a) Compare the bonded and un bonded strain gauges.
 (b) List the procedure to mount a strain gauge with paper backing on the surface under study.
 (c) A 150Ω strain gauge is bonded to a steel bar which is subjected to a tensile load. Cross sectional area of the bar is $0.5 \times 10^{-4} m^2$ and $E = 200 GN/m^2$. If load of 60kN produces a change of 1.5Ω in the gauge resistance. Determine the gauge factor of the gauge. [4+4+8]
7. With neat sketch, explain the following working principles:
 - (a) Pneumatic Load cell
 - (b) Hydraulic load cell
 - (c) Pendulum scale. [5+5+6]
8. (a) Suggest a simple control system which automatically turns on a room lamp at dusk and turn it off in day light . Draw the schematics and block diagram of the suggested control system.
 (b) Distinguish between:
 - i. Position control

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ii. Acceleration control.

[8+8]

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