

II B.Tech. II Semester Regular Examinations, April/May -2005
INSTRUMENTATION AND CONTROL SYSTEMS
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Define the following:
 - i. Measurand
 - ii. Primary measuring element
 - iii. Measurement
 - iv. Calibration
- (b) What do you mean by functional elements? Explain the division of a measurement system into fractional elements with examples.
2. (a) Describe the construction and working of a D.C. tachometer generator. Explain its advantages and disadvantages.
- (b) Explain the construction and working of a Flyball Tachometer. Discuss its merits and demerits.
3. (a) What are the different types of materials commonly used in thermistors?
- (b) Give the various forms of thermistors.
- (c) Explain the temperature-resistance relation of NTC thermistor.
4. (a) Describe the working principle of pirani gauge.
- (b) Describe the method of measurement of differential pressure using an inductive transducer.
5. (a) List out the advantages and limitations of direct method of level measurement.
- (b) Describe with neat sketch the functioning of any two types of displacer type liquid level measuring instruments.
6. (a) Explain the working of piezoelectric accelerometer with neat sketch.
- (b) Name the two types of velocity transducers used for the measurement of vibration and explain any one type with neat sketch.
7. (a) Explain the method of measuring force using strain gauges.
- (b) Why bridge circuit is necessary for a strain gauge? Explain how the bridge circuit is used with a strain gauge.
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.

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1. (a) What are the different standard inputs for studying the dynamic response of a system. Define and sketch them.
(b) A thermometer has a time constant of 3.44. It is quickly taken from a temperature $0^{\circ}C$ to a water bath having a temperature $100^{\circ}C$. what temperature will be indicated after 1.55?
2. (a) Explain the difference in principle of operation of a photo-emissive cell, a photo-conductive cell and a photo voltaic cell. Give the applications of each of these cells.
(b) Differentiate between null mode and deflection of operation of measurement systems with examples.
3. (a) Explain the principle behind the temperature measurement by radiation methods.
(b) Explain the working of a total radiation in pyrometer.
4. (a) Differentiate between pirani-gauge and thermo-couple type conductivity gauge.
(b) Discuss the merits and demerits of the following pressure sensing elements
 - i. Capsule
 - ii. Bourdon tube
 - iii. Bellows
5. (a) List out the importance of calibration of flow measuring instruments
(b) Explain the principle of operation off 'Laser Doppler' flow meter.
6. (a) Explain the working of piezoelectric accelerometer with neat sketch.
(b) Name the two types of velocity transducers used for the measurement of vibration and explain any one type with neat sketch.
7. (a) Discuss the salient features and applications of electrical strain gauges.
(b) Describe the properties of materials used for strain gauges.
(c) List the various factors that are considered for the selection of metallic strain gauges.
8. (a) With suitable examples, bring out the advantages of closed loop systems over open loop systems.

- (b) Draw a block diagram of the closed loop system considered above. Also explain why negative feedback is invariably preferred in such systems.

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1. (a) What do you mean by instrumentation? Write the objectives of instrumentation.
(b) State and explain the desirable static and dynamic characteristics of an instrument.
2. (a) Explain operation of ionization transducer with a neat sketch and write the applications.
(b) Describe the construction and principle of
 - i. LVDT
 - ii. Variable reluctance displacement transducer.
3. (a) A thermistor has a negative resistance temperature co-efficient of 5% over a temperature range of 25°C . What is the resistance at 35°C ?
(b) Discuss in detail about thermopile.
4. (a) Explain the calibration procedure of pressure measuring devices using dead weight tester.
(b) Express the ratio of sensitivities of an inclined manometer to that of a simple manometer in terms of angle "theta". For an inclined manometer six times more sensitive than a simple manometer; what should be the angle of incline.
5. (a) Explain the functioning of ultrasonic flow meter with a neat diagram
(b) With a neat diagram, explain the working of turbine flow meter and point out its limitations.
6. (a) Explain the working of servo accelerometer with neat sketch.
(b) How absolute humidity is measured?
7. (a) Discuss the salient features and applications of electrical strain gauges.
(b) Describe the properties of materials used for strain gauges.
(c) List the various factors that are considered for the selection of metallic strain gauges.
8. (a) A computer controlled fuel injection system that automatically adjusts the fuel-air mixture ratio could improve gas mileage and reduce unwanted polluting emissions significantly. Sketch a block diagram for such a system for an automobile and explain its working.

- (b) Explain with the help of a block diagram the working of the variable speed dc drive control system. State its characteristic and applications.

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1. (a) Describe about the step response of second order system.
- (b) A response test on a thermometer was thrust into temperature controlled bath of water maintained at 100°C and the time was observed as the indicated temperature reached preselected values giving the following readings.

Times(sec)	0.0	1.2	3.0	5.6	8.0	11.0	15.0	18.0
Temp(deg c)	20	40	60	80	90	95	98	99

Draw the response curve on a graph paper and show that it follows closely the form of a simple lag with a time constant of 4 secs.

2. (a) Describe the methods of measurement of speed using
 - i. Resonance tachometer
 - ii. Centrifugal force tachometers.
- (b) Explain working of magnetic pick-up.
3. (a) Differentiate between the thermo couples connected in series and parallel.
- (b) Distinguish between RTD and thermistors.
4. Describe the following methods used for measurement of low pressure using.
 - (a) Thermo couple vacuum gauge
 - (b) Ionization type vacuum gauge.
5. (a) List the various quantity flow meters and explain the working of a Nutating disk flow meter.
- (b) Give details of the magnetic flow meter and Ultrasonic flow meter.
6. (a) Explain the working of servo accelerometer with neat sketch.
- (b) How absolute humidity is measured?
7. (a) Draw a neat sketch and explain the working of unbonded resistance type strain gauge.
- (b) Give the applications of unbonded strain gauges.
- (c) List the drawbacks of bonded type strain gauges.

8. Write short notes on the following:

- (a) Servomechanism
- (b) Temperature control system
- (c) Position control system

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