

III B.Tech. II Semester Regular Examinations, April/May -2005
INSTRUMENTATION AND CONTROL SYSTEMS
(Mechatronics)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Classify different transducers based on operation with examples.
(b) Compare the following :
 - i. Primary transducers Versus Secondary transducers
 - ii. Active transducers Versus Passive transducers
2. (a) List the different types of speed-measuring devices. Explain with neat sketches, the construction and working of any two of them.
(b) Write short note on the Tachogenerators.
3. With neat diagrams explain the construction, working principle of different types of pressure thermometers, compare them.
4. (a) Discuss the working of a Bourdon tube pressure gauge with relevant sketch and mention their merits and demerits.
(b) Explain the basic principle of working of a bellow type pressure gauges.
(c) Sketch the various shapes of bellow used for pressure measurement.
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) What are load cells? Name the application of load cells.
(b) Describe the working principle of strain gauge bridge with neat sketch. Indicate their arrangements for measurement of torque on a circular shaft.
8. (a) The presence of disturbances is the main reason for using feedback control. Justify this statement. Discuss the commonly occurring disturbances in various control systems.
(b) What are feedforward-feedback control system? Give some examples.
(c) Explain with the help of a block diagram any one feedforward-feedback control system.

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1. (a) Explain the following terms related to dynamic characteristics of an instrument
 - i. Speed of response and measuring lag
 - ii. Fidelity and dynamic error
 - iii. Dead time and dead zone
 - iv. Step,ramp and linear input functions
- (b) Define the following terms as applied to the dynamic response of measurement systems subjected to sinusoidal input
 - i. Frequency and circular frequency
 - ii. Undamped natural frequency ,damped natural frequency and resonant frequency
 - iii. Phase shift and time delay
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) What is a thermistor? Write different types.
- (b) What is the range of operation of thermistors? State its applications.
4. (a) Differentiate between Atmospheric pressure and Gauge pressure and Vacuum.
- (b) With the aid of neat sketches, explain the principle of operation of various.
5. With neat sketches explain in detail the functioning of any two flow measuring instruments working on Faraday's law of induced voltage
6. (a) Explain the calibration procedure for an accelerometer.
- (b) What are the different methods of converting vibration into a voltage? Explain any one in detail.
7. (a) Explain the factors affecting the strain measurement.
- (b) Explain the working of servo accelerometer with neat sketch.
8. (a) An automobile driver uses a control system to maintain the speed of the car at a prescribed level. Sketch a block diagram to illustrate this feedback system. Explain various functional elements of this system.

- (b) The student-teacher learning process is inherently a feedback process intended to reduce the system error to a minimum. Construct a feedback model of the learning process and identify each block of the system.

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1. (a) Write the classification of errors.
(b) What is a transducer? State the factors on which transducer selection depends.
(c) Distinguish between active and passive transducers with suitable examples.
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) Explain thermocouple protection materials and for what range they are used.
(b) Explain the construction and working of
 - i. Constant intensity optical pyrometer.
 - ii. Variable intensity optical pyrometer.
4. (a) Differentiate between Atmospheric pressure and Gauge pressure and Vacuum.
(b) With the aid of neat sketches, explain the principle of operation of various.
5. Enumerate the principle of operation of the following
 - (a) capacitative level indicator
 - (b) ultrasonic level measuring instrument
6. (a) Explain the working of servo accelerometer with neat sketch.
(b) How absolute humidity is measured?
7. (a) Draw any four types of strain gauge arrangement for measuring strain.
(b) How resistive strain gauges are calibrated?
8. (a) The presence of disturbances is the main reason for using feedback control. Justify this statement. Discuss the commonly occurring disturbances in various control systems.
(b) What are feedforward-feedback control system? Give some examples.
(c) Explain with the help of a block diagram any one feedforward-feedback control system.

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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) 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 seebeck, peltier and Thomson effects.
- (b) With necessary diagram explain thermocouple laws and mention their significance.
4. (a) Draw a neat sketch of an ionization gauge; explain the working principle of the gauge
- (b) List merits and limitations of ionization gauges.
5. Explain in detail with neat sketches
 - (a) liquid level measurement using capacitive transducer
 - (b) Cryogenic fuel level indicator
6. (a) Compare the working of a servo and digital accelerometers.
- (b) Name the different types of hygrometers used for measuring humidity.
7. (a) Mention the important requirements for a strain gauge material. Name some of the materials used for making strain gauges.
- (b) How resistive strain gauges are calibrated?

8. (a) Distinguish between open-loop and closed loop control systems with the help of a suitable diagram.
- (b) Illustrate your answer using block diagram schematics.
- (c) Identify the system parameters and components in each case.

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