



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - DECEMBER 2022

Regulation: R18

INSTRUMENTATION & CONTROL SYSTEMS

Time: 3 Hours

(MECHANICAL ENGINEERING)

Max Marks: 70

Answer FIVE Questions choosing ONE question from each module

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

MODULE – I

1. (a) Explicate the following: i) Accuracy and Precision. ii) Resolution and Threshold.
iii) Reproducibility and Repeatability. iv) Dead zone and Hysteresis.
[BL: Understand| CO: 1|Marks: 7]
- (b) Explain different types of errors during measurement with an instrument. Suggest various methods to minimize the same.
[BL: Understand| CO: 1|Marks: 7]
2. (a) Draw a block diagram representation of a generalized measurement system. Identify the various systems and elements, and point out the function performed by each element.
[BL: Understand| CO: 1|Marks: 7]
- (b) Explain in detail about calibration with suitable example and also mention the precautions while calibrating any instrument.
[BL: Understand| CO: 1|Marks: 7]

MODULE – II

3. (a) Illustrate with a neat sketch construction and working principle of piezo electric transducer. Mention its advantages and limitations.
[BL: Understand| CO: 2|Marks: 7]
- (b) A Thermistor has a temperature coefficient resistance of -0.04 over a temperature range of $20^{\circ}C$ to $40^{\circ}C$. Find the resistance of the thermistor at $35^{\circ}C$, if the resistance of the thermistor at $30^{\circ}C$ is 200Ω .
[BL: Apply| CO: 2|Marks: 7]
4. (a) List the various types of displacement measuring devices. Interpret the working principle of LVDT with a neat sketch.
[BL: Understand| CO: 2|Marks: 7]
- (b) A platinum resistance thermometer has a resistance of 140.5Ω and 100.0Ω at $100^{\circ}C$ and $0^{\circ}C$ respectively. If its resistance becomes 305.3Ω when it is in contact with a hot gas, determine the temperature of the gas. Take the temperature coefficient of platinum as $0.0039^{\circ}C$
[BL: Apply| CO: 2|Marks: 7]

MODULE – III

5. (a) Describe the functioning of stroboscope and explain how speed of a rotating shaft can be measured using a single pattern and multi-pattern disc?
[BL: Understand| CO: 3|Marks: 7]

- (b) A Stroboscope projects 6000 flashes per minute on a disk mounted on the shaft of a machine. Find the speed of the machine if the disk appears stationary and has a single image of 10 points.

[BL: Apply| CO: 3|Marks: 7]

6. (a) Illustrate with a neat sketch working principle of eddy current tachometer. Give its merits and de merits. [BL: Understand| CO: 4|Marks: 7]
- (b) Illustrate level measurement and give in detail the classification of level measurements available in industry [BL: Understand| CO: 4|Marks: 7]

MODULE – IV

7. (a) Enlist various stress and strain gauage measurements. Determine an expression for gauge factor for resistance strain gauge. [BL: Understand| CO: 5|Marks: 7]
- (b) A single electrical resistance strain gauge of resistance 120Ω 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
- i) Due to a change in stress equal to $1/10$ of the elastic range
- ii) Due to a change of temperature of $200^\circ C$, if the material is advanced alloy. The resistance temperature co-efficient of an advance alloy is $20 \times 10^{-6}/^\circ C$
- [BL: Apply| CO: 5|Marks: 7]
8. (a) Explain in detail about hygroscopic materials and write about the working of any one of the absorption hygrometers. [BL: Understand| CO: 5|Marks: 7]
- (b) How a Wheatstone bridge circuit is used for the measurement of strain. Explain the working of a null balance Wheatstone bridge circuit. [BL: Understand| CO: 5|Marks: 7]

MODULE – V

9. (a) What is the role of control system in engineering applications? Explain four examples of control system applications. [BL: Understand| CO: 6|Marks: 7]
- (b) Describe the working of automatic control system used in practice and outline functional Elements of that system. [BL: Understand| CO: 6|Marks: 7]
10. (a) Compare the pneumatic control systems with hydraulic control systems. Describe in detail about system error in the concept of instrumentation [BL: Understand| CO: 6|Marks: 7]
- (b) Outline a closed loop control system used to control the temperature of water heated by steam in steam power plant. [BL: Understand| CO: 6|Marks: 7]

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