

R18

Code No: 154BC

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February -2024

INSTRUMENTATION AND CONTROL SYSTEMS

(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) What are the static characteristics of a transducer? [2]
- b) Enumerate the properties of piezoelectric materials. [3]
- c) At what temperature K is equal to F ? [2]
- d) Differentiate gauge pressure and vacuum pressure. [3]
- e) Give the principle of direct method and indirect method of liquid level measurement. [2]
- f) Why does a Rota meter call as variable area meter? List any two forces acting on a Rota meter float. [3]
- g) Define relative humidity and absolute humidity. [2]
- h) Explain the different principles used for stress and strain measurement. [3]
- i) What is the difference between 1st order and 2nd order system? [2]
- j) Distinguish between open and closed loop system. [3]

PART – B

(50 Marks)

- 2.a) Briefly discuss about the dynamic performance characteristics of measuring instruments.
- b) What are the desired, modifying and interfering inputs for a measurement system? Give examples for each of these quantities. What is the influence of these on the final output? [5+5]

OR

- 3.a) By employing photoelectric, explain how does displacement measured, with corresponding diagram.
- b) By employing LVDT explain how does displacement is measured with relevant diagram. [5+5]
- 4.a) A platinum resistance thermometer has a resistance of 140.5Ω and 100.0Ω at 100° and 0° respectively. If its resistance becomes 305.3Ω when it is in contact with a hot gas, determine the temperature of gas. Take the temperature coefficient of platinum as $0.0039^\circ\text{C}^{-1}$.
- b) State and explain the different laws of thermocouples. [5+5]

OR

5.a) Explain the principle and working of the McLeod pressure gauge used for low-pressure measurement.

b) Briefly explain the working of optical pyrometer with suitable diagram. [5+5]

6.a) Explain the working principle of operation of turbine flow with neat sketch.

b) A seismic accelerometer sensing displacement has undamped frequency of 20 Hz and a damping ratio of 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 latter is a sinusoidal displacement at a frequency of 30Hz and 1kHz. [5+5]

OR

7.a) With the help of a neat diagram, explain the construction, working and special features of Laser Doppler anemometer.

b) Explain the working of noncontact type tachometer. What are the applications of this instrument? [5+5]

8.a) Briefly discuss about torque measuring methods using strain sensors.

b) A 200Ω strain gauge is bonded to a steel bar which is subjected to a tensile load. Cross-sectional area of the bar is $0.8 \times 10^{-4} \text{ m}^2$ and $E = 200 \text{ GN/m}^2$. Determine the gauge factor of the gauge. [5+5]

OR

9.a) Derive an equation of a gauge factor for strain gauge.

b) Explain the working of electrical humidity sensing absorption hygrometer with relevant diagram. [5+5]

10.a) Derive the transfer functions for Second order mechanical systems.

b) What is a block diagram? Explain the steps involved in the preparation of block diagrams. [5+5]

OR

11.a) Suggest a simple control system that automatically turns on a room lamp at dusk and turns it off in daylight. Draw the schematics and block diagram of the suggested control system.

b) Explain the advantages and disadvantages of open and closed loop system. [5+5]

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