Code No: 155SC **RA**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
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 functional element of generalized measurement system? [2]
b) Define the following:
i) Calibration ii) primary measuring element. [3]
c) Explain the theory of radiation pyrometers. [2]
d) A manometer is used to measure the pressure of a gas in a tank. The fluid used has a specific gravity of 0.85 and monometer column height is 55cm. If local atmosphere pressure is 96kPa. What is the absolute pressure of the tank? [3]
e) Discuss about Vena contracta point. [2]
f) Enumerate the various electrical methods that are available for level measurement. [3]
g) Explain the limitations of elastic force meters. [2]
h) Define relative humidity, absolute humidity and dew point. [3]
i) Give the classification of control systems. [2]
j) What is a servo mechanism? And list its application. [3]

PART – B

(50 Marks)

2.a) By employing LVDT explain how displacement is measured with relevant diagram.
b) With help of a neat diagram, explain the generalized input output configuration model. [5+5]

OR

3.a) Define measurement and explain its significance in our day to day life.
b) Explain the dynamic performance characteristics of measuring instruments. [5+5]

4.a) Explain how thermocouples are used for temperature measurement?
b) Explain the operation of pirani thermal conductivity gauge for pressure measurement with a sketch. [5+5]

OR

5.a) A McLeod gauge has a capillary of 1mm diameter and a bulb of 100 c.c. Calculate the pressure indicated by a reading of 20 mm. What error would result in the measurement if the volume of capillary is dropped in comparison with the volume of the bulb?
b) State law of thermocouples. How are the laws useful in construction of thermocouple thermometers? [5+5]

6.a) Explain the working principle of operation of hot wire anemometer with neat sketch.

b) A seismic accelerometer sensing displacement has and 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) Distinguish between the direct and indirect modes of level measurement. Discuss in brief about the methods.

b) Explain the working principle of operation of turbine flow meter with neat sketch. [5+5]

8.a) Explain the working principle of strain gauge torsion meter with a neat diagram.

b) Discuss in detail the working of any one type of dynamometers used for force measurement. [5+5]

OR

9.a) How does a mechanical load cell work? Explain the principle of measuring shaft torque using strain gauge torsion meter.

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

10.a) What is a block diagram? Explain the steps involved in the preparation of block diagrams.

b) Explain the concept of control in engineering. List several control devices with which you are familiar and describe any two of them. [5+5]

OR

11.a) Describe a typical closed loop control system that can be used to control the temperature of water being heated by steam.

b) State advantages and limitations of open-loop and closed loop control system. [5+5]

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