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## Seventh Semester B.E. Degree Examination, July/August 2022 Process Control and Instrumentation

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Explain the static and dynamic characteristics of an instrument. (10 Marks)  
b. Explain with a neat sketch, the construction and operation of a Bourden-Pressure gauge. Give its advantages, disadvantages and applications. (10 Marks)

OR

- 2 a. Explain briefly on classification of control system. (10 Marks)  
b. Write a note on thermo couples and pyrometers. (10 Marks)

### Module-2

- 3 a. Explain response for various input forcing functions. (10 Marks)  
b. Write a note on First Order System. (10 Marks)

OR

- 4 a. Obtain the dynamic behavior of a mercury thermometer, stating all assumptions made. (12 Marks)  
b. A vapour pressure thermometer of first order characteristics takes 5 sec to indicate 70% of the final temperature. Calculate the time constant of the thermometer. (08 Marks)

### Module-3

- 5 a. Explain and derive with block diagram on servo and regulatory problems. (12 Marks)  
b. Explain with neat schematic representation of a pneumatic positioner. (08 Marks)

OR

- 6 a. Explain proportional band. (05 Marks)  
b. A proportional controller is used to control temperature within the range of 60-100°C. The controller is adjusted so that the output pressure goes from 3 Psi to 15 Psi. As measured temperature goes 71-75°C with the set point head constant. Find the gain of the proportional band. (15 Marks)

### Module-4

- 7 a. Define the stability of a system. What are the methods used to analyze the stability of control systems. (10 Marks)  
b. Discuss the stability of control system represented by the characteristic equation,  
 $s^4 + 3s^3 + 5s^2 + 4s + 2 = 0$  (10 Marks)

**OR**

- 8 Open loop transfer function of a chemical process is given by,

$$G(s) = \frac{K}{(s+1)(50s^2 + 12s + 05)}$$

Find out the range of K for which this system is stable. What will be the frequency of sustained oscillation? **(20 Marks)**

**Module-5**

- 9 a. Write and explain the rules to plot root locus. **(10 Marks)**  
b. What are the merits and demerits of root locus technique to determine the stability? **(10 Marks)**

**OR**

- 10 a. Explain Gain and Phase margins. **(05 Marks)**  
b. Plot the root locus diagram for the open loop transfer function,

$$G = \frac{K}{(s+1)(s+2)(s+3)}$$

**(15 Marks)**

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