CBCS SCHEME

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18BT61

Sixth Semester B.E. Degree Examination, June/July 2025
Process Control and Automation

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain with a neat diagram, the working principle of thermocouple and thermister. **(10 Marks)**

b. Discuss online and offline measurement of biomass estimation. **(10 Marks)**

OR

2 a. Discuss flow injection analysis for measurement of substrate and products. **(10 Marks)**

b. Enumerate the important physico-chemical and biochemical parameter in dynamics of bioprocess with outline diagram of bioreactor. **(10 Marks)**

Module-2

3 a. Derive the transfer function of liquid level first order system with all assumptions. **(08 Marks)**

b. Compare feedback and feed forward control systems with suitable examples. **(06 Marks)**

c. Obtain the response of the thermometer for a step input and discuss its important features. **(06 Marks)**

OR

4 a. Derive the transfer-function for a three tank non interacting system in series and its step response. **(10 Marks)**

b. A thermometer is kept inside a constant temperature bath at 70°C. This is suddenly transferred into another bath kept at 60°C at t = 0. The following are the readings recorded.

Time in minute	Temperature °C
0	70
2	68
4	66
5	64
8	63
10	61.5
12	61

Find out the time constant for thermometer

(10 Marks)

Module-3

5 a. Derive the transfer function to show that U-tube monometer follows the second order system and state all the assumptions. **(10 Marks)**

b. Derive a step response equation for second order system. **(10 Marks)**

OR

6 a. For a second order under damped, explain the following terms with the help of neat sketch, i) Overshoot ii) Decay ratio iii) Rise time iv) Response time v) Period of oscillation. **(10 Marks)**

b. A step change of magnitude 4 is introduced into a system having transfer function $\frac{Y(s)}{X(s)} = \frac{10}{s^2 + 1.6s + 4}$. Determine :
i) % overshoot ii) Rise time iii) Maximum value of Y(t) v) Period of oscillation. **(10 Marks)**

Module-4

7 a. Derive the transfer function which relates the output and error signal for the control modes. Discuss their dynamic behaviour for linear change in error
i) PD controller ii) PID controller. **(10 Marks)**

b. In a PID controller the error in increased linearly at the rate of 5°C/min. The proportional sensitivity of the PID controller is 4, the reset rate is 1 and the derivative time is 0.5. Obtain the response of PID controller. **(10 Marks)**

OR

8 a. Derive the expression for the transfer function of servo and regulatory problem in control system. **(10 Marks)**

b. Explain with a neat sketch, various components and functioning of a pneumatic control valve. **(10 Marks)**

Module-5

9 a. Determine the stability of the closed loop transfer function :
$T(s) = \frac{10}{s^5 + 2s^4 + 3s^3 + 6s^2 + 5s + 3}$. **(10 Marks)**

b. Draw the Bode diagram for the first order system and explain. **(10 Marks)**

OR

10 a. Open loop transfer function of a chemical process in given by :
$G(s) = \frac{K}{(s+1)(50s^2 + 12s + 0.5)}$.
Find out the range of K for which system is stable, what will be the frequency of sustained oscillator. **(10 Marks)**

b. Discuss the Nyquist stability criteria of control system. **(10 Marks)**

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