CBCS SCHEME

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18BT61

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.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 sketch, the principles and operation of pressure measuring instruments. **(10 Marks)**

b. Describe on-line method of Biomass estimation. **(04 Marks)**

c. Define the following :
i) Instrumentation ii) Process control iii) Automation. **(06 Marks)**

OR

2 a. With a neat sketch, explain flow injection analysis. **(10 Marks)**

b. Explain with various modes of temperature measuring devices. **(10 Marks)**

Module-2

3 a. Derive the transfer function of first order liquid level system. **(10 Marks)**

b. Given a system with the transfer function $\frac{y(s)}{x(s)} = \frac{(\tau_1 s+1)}{(\tau_2 s+1)}$. Find y(t) if x(t) is a unit step function. If $\frac{\tau_1}{\tau_2} = 5$. Sketch y(t) versus $\frac{t}{\tau_2}$ show the numerical values of minimum, maximum and ultimate values that may occur during the transient. **(10 Marks)**

OR

4 a. Define Linearization. With an example of liquid level system, explain the concept. **(10 Marks)**

b. With a neat sketch, explain the first order system for non-interacting system. **(10 Marks)**

Module-3

5 a. Derive the transfer function for the 2^{nd} order system for a spring damper. **(10 Marks)**

b. Define and explain :
i) Overshoot ii) Rise time iii) y_{max} iv) Period of oscillation v) Peak time. **(10 Marks)**

OR

6 a. What do you mean by transportation lag? Derive transfer function for transportation lag. **(10 Marks)**

b. Explain the significance of damping ratio (ξ) graphically. **(04 Marks)**

c. Derive an expression for the step response of non interacting multicapcity control system. **(06 Marks)**

Module-4

7 a. What is FCE? Add a note on it. **(04 Marks)**

b. Determine the overall transfer function C(s)/R(s) for the system shown in Fig Q7(b)

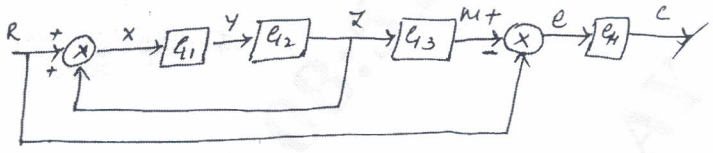

Fig Q7(b) **(06 Marks)**

c. Derive an expression for Regulator control problem for negative feedback system. **(10 Marks)**

OR

8 a. Define controller. Explain two mode controllers with example. **(10 Marks)**

b. In a PID controller the error is 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 τ_D is 0.5 min. Obtain the response equation. **(10 Marks)**

Module-5

9 a. Discuss the Routh test for stability, and theorems on Routh test. Add a note on merits and demerits of the same. **(10 Marks)**

b. Find : i) Characteristic equation ii) Determine the value of K_c for which control system is stable iii) For which value of K_c the control system is on the threshold of stability.

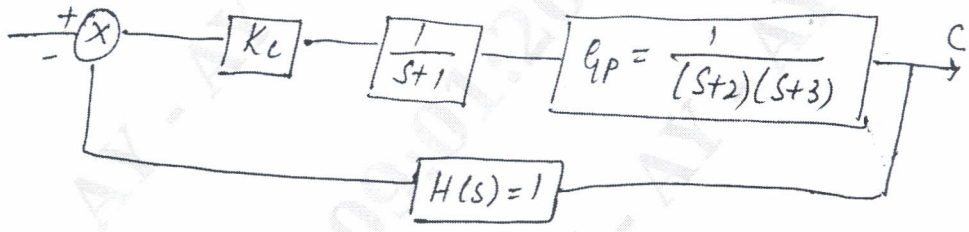

Fig Q9(b) **(10 Marks)**

OR

10 a. Explain the rules for plotting the Root locus diagram. **(10 Marks)**

b. Plot a Root locus, gives open loop transfer function G H(s) = $\frac{K_C}{s(s+1)(s+2)}$. Determine the value of K_c for which the control system is just unstable. **(10 Marks)**

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