CBCS SCHEME

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21BT62

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Bioprocess Principles, Control and Automation + Lab

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Classify temperature and pressure measuring instruments. With neat sketch, explain two types of pressure measuring devices. **(12 Marks)**

b. Briefly explain the online method of biomass estimation. **(08 Marks)**

OR

2 a. With a neat diagram, explain the working principle of thermocouples and resistance thermometers. **(08 Marks)**

b. Explain the flow injection analysis for the measurement of substrate. **(06 Marks)**

c. What are the static and dynamic characteristics of instruments? **(06 Marks)**

Module-2

3 a. Define and explain mathematically the various forcing functions. **(08 Marks)**

b. A mercury thermometer having a time constant of 0.1 min is placed in a temp bath of 100°F and allowed to come to equilibrium with bath. At time t = 0 , temperature of bath begins to vary sinusoidally about its average temp of 100°F with the amplitude of 2°F. If the frequency of oscillation is ($^{10}/_{11}$) cycles / minute. What is phase lag? **(12 Marks)**

OR

4 a. Derive the transfer function for liquid level in the tank for constant flow outlet. **(10 Marks)**

b. A thermometer having a time constant of 10s is placed in a temperature bath. After the thermometer reaches steady state temperature of 30°C, it is suddenly placed in hot fluid at 60°C. Sketch the response of thermometer. **(10 Marks)**

Module-3

5 a. Overall Transfer function of the control system to given as

$$G(s) = \frac{16}{1.5s^2 + 2.4s + 6}$$

A step change of magnitude 6 is introduced into the system. Determine i) Overshoot ii) Period of oscillation iii) Rise time iv) Ultimate value of response v) Maximum value of response. **(10 Marks)**

b. Derive the transfer function for two tank non – interacting system. **(10 Marks)**

OR

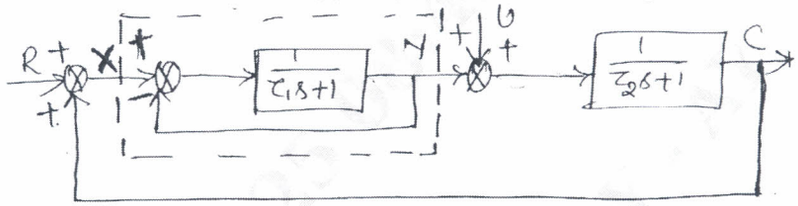
6 a. Derive the step response equation for second order system for under damped condition. **(10 Marks)**

b. Obtain the transfer function for a U – tube manometer. **(10 Marks)**

Module-4

7 a. Derive the transfer function of the servo and regulator mechanism for negative feedback system. **(10 Marks)**

b. Derive the overall transfer function C(s) / R(s) for the block diagram. **(10 Marks)**



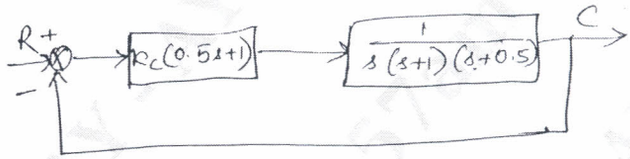
OR

8 a. Obtain the transfer function for i) Propositional controller
ii) Propositional Derivative controller iii) Propositional Integral controller
iv) Propositional – Integral Derivative controller. **(12 Marks)**

b. A unit step change is given to a PI controller. If the propositional gain (K_C) is 4, integral time is 2, obtain the response of PI controller. **(08 Marks)**

Module-5

9 a. A control system is represented by means of a block diagram. **(10 Marks)**



b. Explain the stepwise procedure for Root – Locus diagram. **(10 Marks)**

OR

10 a. Obtain the frequency response for first order system. **(10 Marks)**

b. Write a note on :
i) Bode plot ii) Stability criterion. **(10 Marks)**

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