CBCS Scheme

USN | | | | | | | | | | |

15BT62

Sixth Semester B.E. Degree Examination, June/July 2018
Bioprocess Control and Automation

Time: 3 hrs. Max. Marks: 80

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 and flow measuring instruments. **(08 Marks)**

b. Explain the various physico-chemical and biological parameters which are measured and controlled in a bioreactor. **(08 Marks)**

OR

2 a. With a neat sketch explain flow injection analysis. **(08 Marks)**

b. Describe on-line method of biomass estimation. **(08 Marks)**

Module-2

3 a. Derive the transfer function of first order system taking a suitable example. **(08 Marks)**

b. A thermometer having first order dynamics is placed in a temperature bath at 40°C. After thermometer reaches a steady state, it is suddenly placed in a temperature bath at 50°C at t = 0 and left there for 1 min and removed immediately to the temperature bath at 40°C. Draw the sketch showing the variations of thermometer reading with time. Also calculate the thermometer reading at time t = 0.5 min and t = 2 min. **(08 Marks)**

OR

4 a. Derive the transfer function for 2 tank non interacting system. **(08 Marks)**

b. What are the different forcing function used in control system with their Laplace transform. **(08 Marks)**

Module-3

5 a. Derive the transfer function for the 2^{nd} order system for a spring damper. **(08 Marks)**

b. What do you mean by transportation lag? Derive transfer functions for transportation lag. **(08 Marks)**

OR

6 a. A step change of magnitude 4 is introduced into the system having the transfer function.

$$\frac{y(s)}{\alpha(s)} = \frac{4}{s^2 + 1.6s + 4}$$

Determine : i) Overshoot ii) Rise time iii) Peak time iv) Period of Oscillation
v) $Y_{altimath}$ vi) Y_{max} **(12 Marks)**

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

Module-4

7 a. Write the equations relating the output and error signal for the following control modes.
i) PD controller ii) PID controller.
Obtain their transfer functions. Discuss their dynamic behaviour for linear change in error. **(10 Marks)**

b. A step change of magnitude 4 is introduced into a PI controller. The value of gain is 6 and reset rate is 0.5 plot the response of the PI controller. **(06 Marks)**

OR

8 a. Determine the overall transfer function $\frac{C(s)}{R(s)}$ for the Fig Q8(a) given below:

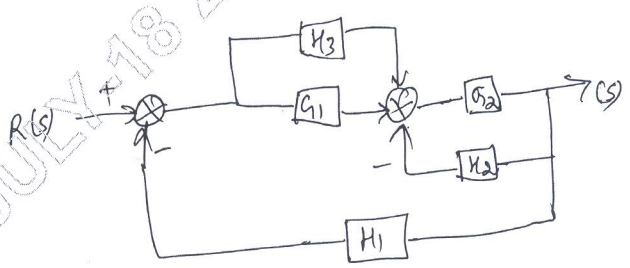

Fig Q8(b) **(08 Marks)**

b. Derive the offset equation for proportional controller for servo mechanism. **(08 Marks)**

Module-5

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

b. Define stable and unstable system and give the examples for the same. What is the characteristic equation for control system? **(06 Marks)**

OR

10 a. Explain the rules for plotting the Root locus diagram. **(06 Marks)**

b. Determine the stability of control system whose characteristic equation is $s^6 + 4s^5 + 3s^4 + 2s^3 + s^2 + 4s + 4$ **(05 Marks)**

c. Write a note on Bode plot. **(05 Marks)**

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