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ECH602

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15

PROCESS DYNAMICS & CONTROL

Time : **3** Hours]   [Total Marks : **100**

Note :   Attempt **all** questions. Assume suitable data, if required. **All** questions carry equal marks.

1   **Attempt any four parts of the following :**   **5×4=20**

(a)   What are the design elements of control system ? Explain with examples.

(b)   Differentiate between positive feedback and negative feedback control taking suitable examples ?

(c)   A thermometer having time constant of 1 min is initially at 50 °C. It is immersed in a bath maintained at 100 °C at t = 0. Determine the temperature reading at t = 1.2 min.

(d)   Discuss the principle characteristics of the first-order system and describe the physical meaning of the time constant for the first order system.

(e)   What is the importance of initial and final value theorem in the study of process dynamic control ?

(f)   Find the inverse Laplace of $Y(s) = 1/S^2(S+1)$.

151602]   **1**   **[Contd...**

2 **Attempt any two parts of the following :** **10×2=20**

(a) Derive transfer function of single tank liquid level system. Draw a suitable sketch.

(b) Consider a second order system with following transfer function

$$Y(s)/X(s) = 16 /(1.5S^2 + 2.4S + 6)$$

Introduce a step change of magnitude 6 into the system and find

(i) Percent overshoot

(ii) Decay ratio

(iii) Ultimate value of y (t)

(iv) Rise time

(c) Discuss the characteristics of under damped response and plot the graph of overshoot and decay versus damping factor.
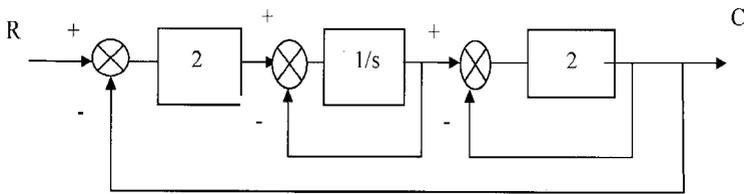
3 **Attempt any two parts of following :** **10×2=20**

(a) Differentiate between servo control problem and regulator control problem with the help of suitable examples ?

(b) What are the modes of control action ? Discuss the advantages and limitations.

(c) Explain the response of a closed loop control system for various types of control actions.

4 **Attempt any two parts of the following :** **10×2=20**

(a) Explain the Routh test for stability of a control system ? Check the stability of system described by following equation.

$$S^4 + 3S^3 + 5S^2 + 4S + 2 = 0$$

(b) Evaluate the amplitude ratio and phase difference for the following by substitution rule :

(i) First order and Second order system

(ii) PI and PD controller

(c) Find the transfer function C(s)/R(s) of the system shown in figure.

5 Attempt any two parts of the following : 10×2=20

(a) Draw a neat sketch and explain

(i) Feed-back control action

(ii) Feed-forward control action.

(b) Explain the Ziegler-Nichols settings result from closed loop considerations, where as the cohen-coon settings are determine the open loop response of the control system.

(c) Explain the analysis of cascade control. Name the main advantage and disadvantage of cascade control.