BT–6/M05

Control System

Paper : EE-304

Time : Three Hours] [Maximum Marks : 100

Note : Attempt any **FIVE** questions. All questions carry equal marks.

1. (a) How will you classify the various control systems ? Compare open loop with closed loop system with examples. 10

   (b) Draw the signal flow graph of the system for the following equations

   $x_2 = t_{12}x_1 + t_{32}x_3$

   $x_3 = t_{23}x_2 + t_{43}x_4$

   $x_4 = t_{24}x_2 + t_{34}x_3 + t_{44}x_4$

   $x_5 = t_{25}x_2 + t_{45}x_4$. 10

2. (a) Evaluate the steady state error of a unity feedback system whose open loop transfer function is given by

   $G(s) = \dfrac{100}{s(1+0.5s)}$ when excited by Input $R(t) = 3 + 2t$. 10

   (b) Explain Time domain and Frequency domain analysis. 10

3. (a) What are the limitations of Routh-Hurwitz's criterion for the stability ? How do you determine relative stability ? 10

   (b) Using Routh-Hurwitz criterion, investigate the stability of the system whose characteristic equation is 10

   $$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0.$$

4. Using Nyquist criterion, investigate the stability of a closed loop control system whose open-loop transfer function is given below. 20

   $$G(S)H(S) = \frac{K}{S(ST_1 + 1)(ST_2 + 1)}.$$ 20

5. Draw the Bode-plot for the transfer function given below :

   $$G(s)H(s) = \frac{48(s+10)}{s(s+20)(s^2 + 2 \cdot 4s + 16)}.$$

   Apply correction to the magnitude plot for the quadratic term and comment on the stability. 20

6. A unity feedback control system has an open-loop transfer function

$$G(s)=\frac{K}{s(s+4)}$$

Draw the root locus and determine the value of K if the damping ratio ξ is to be 0.707. 20

7. (a) The transfer function of a control system is given by :

$$\frac{Y(s)}{U(s)}=\frac{s+2}{s^3+9s^2+26s+24}$$

Check for controllability and observability. 15

(b) What are error detectors and signal conditioners ? 5

8. Write short notes on the following :

(a) PID Control

(b) AC Servomotor

(c) Tacho generators. 6, 7, 7

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