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BIEL-020

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

June, 2017

00734

BIEL-020 : CONTROL ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. All questions carry equal marks. Use of scientific calculator is permissible. Use of graph paper and semi-log sheet is allowed.*

1. Obtain the signal graph of the system whose block diagram is given in Figure 1 and hence determine the transfer function using Mason's gain formula. *10*

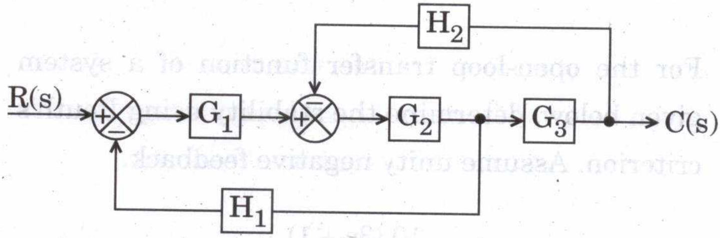

Figure 1

2. Use block diagram reduction methods to obtain the overall transfer function C/R for the block diagram shown in Figure 2. *10*

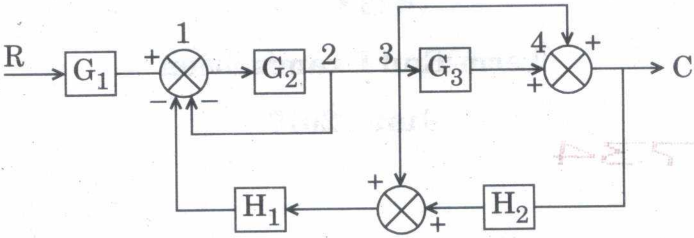

Figure 2

3. Evaluate the value of gain K, such that the system shown in Figure 3 has a 10% steady-state error for a ramp input. *10*

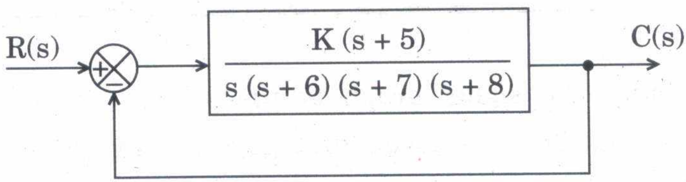

Figure 3

4. For the open-loop transfer function of a system given below, determine the stability using Routh's criterion. Assume unity negative feedback. *10*

$$G(s) = \frac{10\,(3s + 1)}{s\,(s + 1)\,(6s + 1)\,(0{\cdot}1s + 1)}$$

5. A unity feedback control system has forward path transfer function as

$$G(s) = \frac{K(1-s^2)}{s(1+4s)}.$$

Apply Nyquist stability criterion to determine the value of K, which makes the system just stable. *10*

6. For a given system with H(s) = 1 and

$$G(s) = \frac{1}{s(s+1)(s+0{\cdot}5)},$$

determine the following : *3+3+4=10*

(a) Phase crossover frequency

(b) Gain crossover frequency

(c) Gain Margin and Phase Margin

7. Sketch the root locus for

$$G(s) = \frac{K}{s(s+1)(s^2+7s+12)}$$

for K < 0. *10*

8. Obtain the transfer function for the control system having state space model as

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -4 & -1 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 3 \\ 2 \end{bmatrix} [u]$$

and $y = [2 \quad 3] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$. *10*

9. Construct all the possible state models for a system characterised by the differential equation

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 6y = u(t).$$

Draw the block diagram representation of the state model. *10*

10. Write short notes on any ***two*** of the following : *5+5=10*

(a) Lead and Lag Compensator

(b) PID Controller

(c) All-Pass and Minimum-Phase Systems