No. of Printed Pages : 4

BIEL-020

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

Term-End Examination

00593

December, 2016

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.*

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1. Determine the transfer function C(s)/R(s) for the system given in the Figure 1 using block diagram reduction techniques. *10*

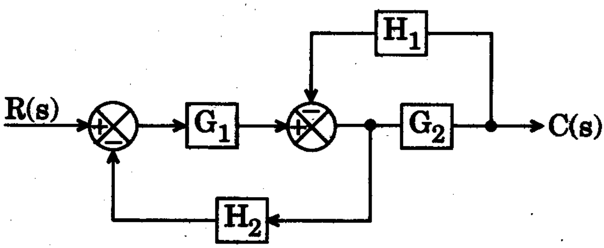

Figure 1

2. For the unity feedback system having open-loop transfer function as $G(s) = \frac{K(s+2)}{s^2(s^2+7s+12)}$, determine (a) type of the system, (b) error constants K_p, K_v and K_a, and (iii) steady state error for parabolic input. *10*

3. Determine the % overshoot and the time to reach peak overshoot for the system shown in Figure 2, when a unit step input is applied. *10*

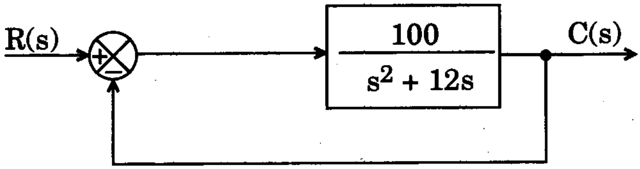

Figure 2

4. Consider the closed-loop feedback control system shown in Figure 3.

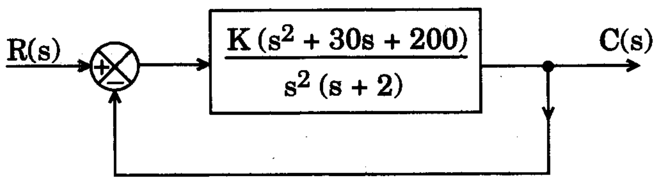

Figure 3

Using Routh-Hurwitz criterion, determine the range of K for which the system is stable. Also find the number of roots of the characteristic equation that are in the right half of s-plane for $K = 0{\cdot}5$. *10*

5. A unity feedback system has an open-loop transfer function $G(s) = \dfrac{(s+2)}{(s+1)(s-1)}$. Using Nyquist criterion, determine whether the closed-loop system is stable or not. *10*

6. For a closed-loop unity feedback system whose open-loop transfer function is given by

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

(a) Draw the Bode diagram.

(b) Obtain the phase margin and gain margin. *5+5=10*

7. Sketch the root locus diagram for $G(s)\ H(s) = \frac{K}{s\,(s+1)\,(s+3)}$. Determine the gain and the phase margin for K = 10. *10*

8. Determine the state space representation in phase variable form for the system whose closed-loop transfer function is given by

$$\frac{C(s)}{R(s)} = \frac{24}{s^3 + 9s^2 + 26s + 24}.$$ *10*

9. Check whether the following system is completely state controllable and completely observable : *10*

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 20 & 9 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

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

(a) Neural Network Based Control

(b) Fuzzy Logic Control

(c) Asymptotic and Conditional Stability