PVP 14

Code: EC4T1

**II B.Tech - II Semester–Regular/Supplementary Examinations**
**April 2019**

# CONTROL SYSTEMS
## (ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22

1.

a) A transfer function has two zeros and poles at origin. Then what is the relation between the numerator degree (N) and the denominator degree (M) of the transfer function and plot on s-plane.

b) Explain how feedback affects overall gain of the system?

c) Consider a unity feedback control system with open loop transfer function $G(s) = \frac{9}{s(s+1)}$. Find the steady state error of the system due to unit step input.

d) What are the standard test inputs used in control systems and write their Laplace transforms.

e) Explain the construction rules for root locus technique

f) Consider the fourth-order polynomial: $s^4 + 2s^3 + 3s^2 + 4s + 5 = 0$. How many roots of this equation have positive real parts?

g) Why frequency domain compensation is normally carried out using the Bode plots?

h) State the Nyquist Stability criterion.

i) Obtain the state transition matrix for $A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$

j) List out the advantages of state space techniques.

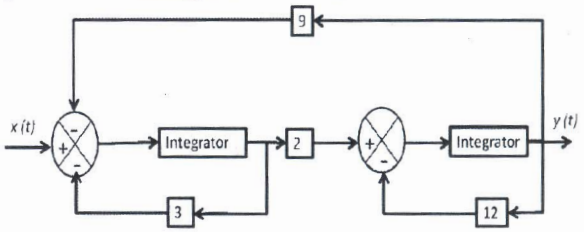
k) List out the properties of state transition matrix.

## PART – B

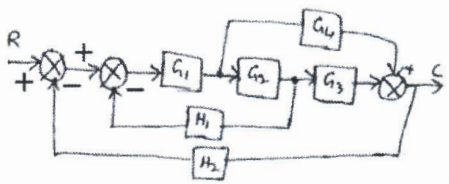
Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) Draw the signal flow graph for the following block diagram and find the transfer function $G(s) = Y(s) / X(s)$ for the system by using Mason's gain formula. 8 M




b) Find the transfer function of the following by using block diagram reduction technique. 8 M




3. a) When the system shown in figure 3 (a) is subjected to a unit-step input, the system output responds as shown in figure 3(b) Determine the values of K and T from the response curve. 8 M

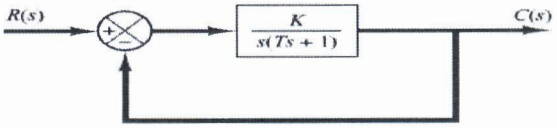



Figure 3 (a)

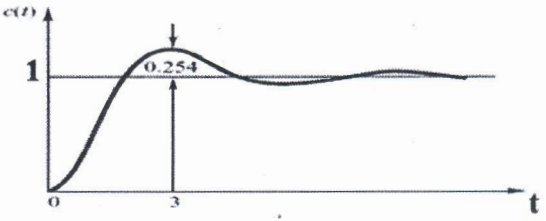
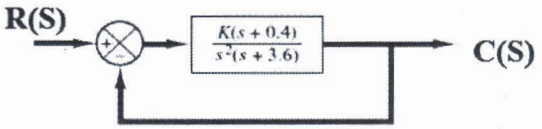



Figure 3 (b)

b) For a unity feed back system $G(s)H(s) = \frac{K}{s^2(s+2)(s+3)}$.
Find the value of the K to limit steady state error to 10 when input to system is $1 + 10t + 20t^2$ 8 M

4. a) Consider the equation
$s^6 + 4s^5 + 3s^4 - 16s^2 - 64s - 48 = 0$. Find the number of roots of this equation with positive real part, negative real part and zero real part by using RH criterion. 8 M

b) Sketch the root loci for the system shown in figure below. 8 M



5. Consider a unity feedback system $G(s) = \frac{242(s+5)}{s(s+1)(s^2+5s+121)}$. Sketch the Bode plot and find gain margin and phase margin. 16 M

6. a) A first order matrix differential equation of a system is given as $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}\begin{bmatrix}0\\ 2\end{bmatrix}u, y = \begin{bmatrix}1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$
Find the solution of the states and the output when the input is a unit step and the initial condition of the states is $\begin{bmatrix}0\\ 1\end{bmatrix}$.
8 M

b) Consider the signal flow graph shown in figure below. Obtain the state space model with $x_1$, $x_2$, $x_3$, and $x_4$ as state variable and write the transfer function directly from the state space model. 8 M