PVP 14

Code: EC4T1

II B.Tech - II Semester – Regular / Supplementary Examinations
October - 2020

CONTROL SYSTEMS
(ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks:70

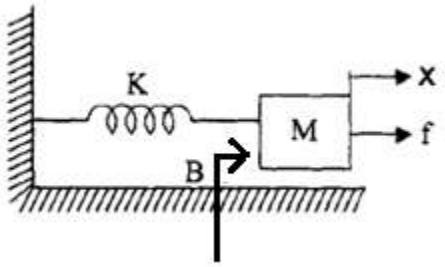
PART – A

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

11 x 2 = 22 M

1.

a) What are the limitations of transfer function approach in control systems?
b) Write Mason's gain formula.
c) Write force balancing equations for the mechanical system shown in figure and find the transfer function X(S)/F(S).



d) What are the time domain specifications? Why these specifications are required?
e) What is the steady state error of a type one system with unit step input?
f) What is characteristic equation? How it is related to stability?

g) Define root locus.

h) What is the initial slope of Bode plot for the following transfer function

$$G(S) = \frac{KS^2}{(1+0.01S)(1+0.02S)(1+S)}$$

i) What is the significance of -1+j0 in Nyquist plot?

j) Define state variable.

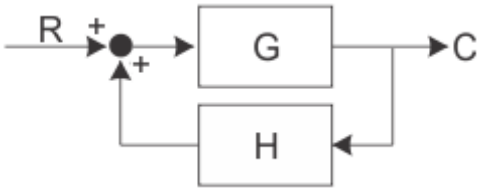
k) List the properties of state transition matrix.

PART – B

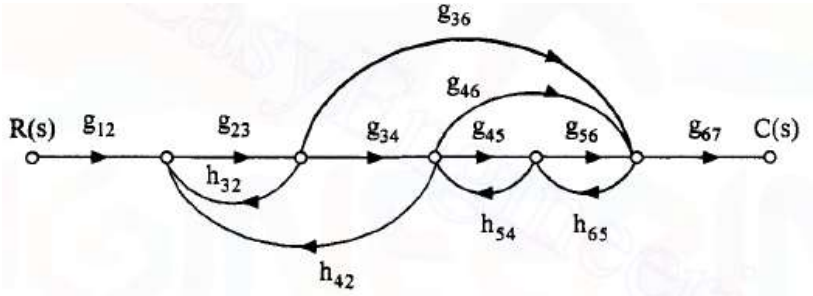
Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) Prove that $\frac{C}{R} = \frac{G}{1-GH}$ for the block diagram shown in figure below. 4 M

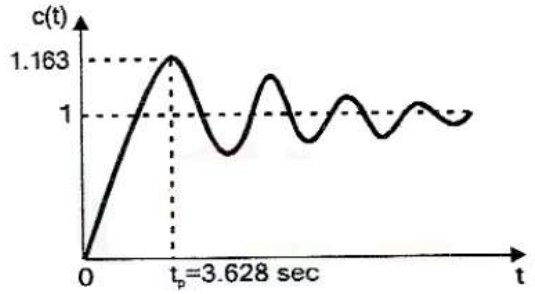


b) For the signal flow graph shown in figure, find the transfer function C(S) / R(S) 12 M



3. a) Explain briefly how controllers will improve the transient and steady state performance of feedback control systems. 6 M

b) Determine the transfer function from the time domain response of the second order system with unit step i/p shown in figure below. 10 M



4. a) Examine the stability of the characteristic polynomial for K ranging from 0 to ∞. Use Routh-Hurwitz criterion.
$D(s) = s^4 + 20\,Ks^3 + 5s^2 + 10s + 15$ 6 M

b) From the concept of root locus determine range value of K for the system to be stable whose characteristic equation is given by $S^4 + 6S^3 + 8S^2 + KS + K = 0$ 10 M

5. a) Sketch the polar plot for a given open loop transfer function
$G(S)H(S) = \frac{5}{S\,(S+2)\,(S+4)}$ 6 M

b) For the following transfer function, draw the Bode plot and obtain gain cross over frequency.
$G(S) = \frac{20}{S(1+3S)(1+4S)}$ 10 M

6. a) Explain the concept of Controllability and observability. 6 M

b) The State equation of a Linear system are as follows.

$$\bar{x} = \begin{bmatrix} -2 & 0 & 1 \\ 1 & -3 & 0 \\ 1 & 1 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u \quad ; y = [2\ 1\ -1]\ x$$

Determine transfer function Y (S) / U (S) . 10 M