PVP 14

Code: EE4T5

II B.Tech - II Semester – Regular Examinations – May 2016

CONTROL SYSTEMS
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

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

11x 2 = 22 M

1)

a) State the examples of open loop and closed loop control systems.

b) Closed loop transfer function of the system $M = \frac{G(s)}{1 + G(s)H(s)}$. Determine the sensitivity of the transfer function with respect to feedback path gain H(s).

c) What are the limitations of Transfer Function Approach?

d) Distinguish between type and order of a control system?

e) If the unit step response of a second order linear system with zero initial state is given by $c(t) = 1 + 1.25 \sin(8t - \tan^{-1} 0.333)$, then find the damping ratio and un-damped natural frequency.

f) Why negative feedback is preferred in control systems?

g) Define i) Relative stability

ii) Absolute stability

h) Define gain margin and phase margin.

i) Define state transition matrix and write the formula to compute STM.

j) Derive the transfer function from state model.

k) Draw the polar plots for order -2- type – I system and order -3- type – I system.

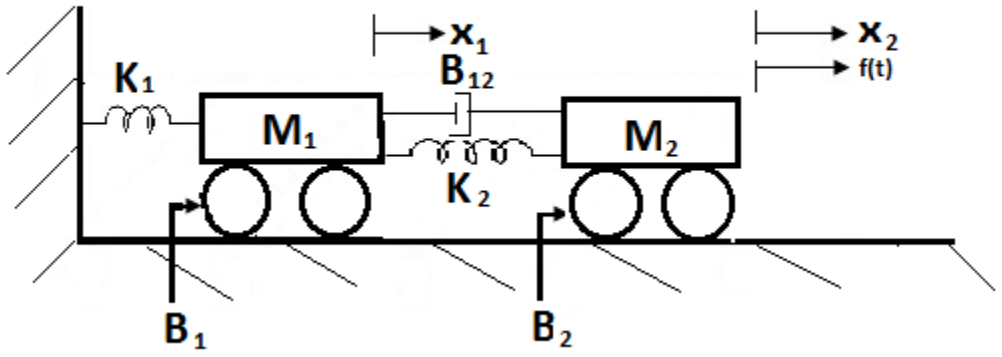
PART – B

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

3 x 16 = 48 M

2)

a) Determine the transfer function $\left[\frac{X_2(S)}{F(S)}, \frac{X_1(S)}{F(S)}\right]$ for given mechanical translational system. 8 M



b) Derive the transfer function for DC Servomotor for field controlled and armature controlled. 8 M

3)

a) A second order system is given by $\frac{C(s)}{R(s)} = \frac{25}{s^2 + 6s + 25}$. Find its rise time, peak time, peak overshoot and settling time if subjected to unit step input? Also calculate expression for its output response. 10 M

b) Consider a unity feedback system with a closed transfer function $\frac{C(s)}{R(s)} = \frac{ks + b}{s^2 + as + b}$. Determine the open loop transfer function G(s). Show that the steady state error with unit ramp input is given by $\frac{(a - k)}{b}$. 6 M

4) Sketch the root locus plot of the system whose open loop transfer function is given by

$$G(s)H(s) = \frac{K}{s(s + 4)(s^2 + 4s + 13)}.$$ 16 M

5) A unity feed-back control system has the transfer function $G(s) = \frac{80}{s(s + 2)(s + 20)}$. Draw the bode plot and hence determine GM, PM, ω_{gc} and ω_{pc} .Comment on the stability? 16 M

6)

a) Convert the given transfer function into state space form?

$$\frac{Y(s)}{U(s)} = \frac{s^2 + 2s + 4}{s^3 + 3s^2 + 6s + 10}$$ 8 M

b) A linear time invariant system is characterized by the homogeneous state equation as $\dot{x}(t) = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} x(t)$. Find the state transition matrix and hence obtain the time response of the system? Assume the initial state vector is $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, c=[1 0] 8 M