Exam. Code: 0930
Sub. Code: 33678

2015

B.E. (Electronics and Communication Engineering)

Sixth Semester

EC-624: Control System

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part. Use a semi-log graph paper to draw the bode plot. Use a normal graph paper to draw the root locus plot and the nyquist plot.***

x-x-x

Q1. (i) Write the properties of state transition matrix.

(ii) What is a signal flow graph? How to find the transfer function using it?

(iii) How can polar plot be used in determining the phase margin?

(iv) Define rise time. How is it different from delay time?

(v) What are the basic elements in a mechanical system?

(2x5)

Part-A

Q2. (a) Construct the Routh Array and determine the stability range of 'K' for a system having the characteristic equation as: **(5)**

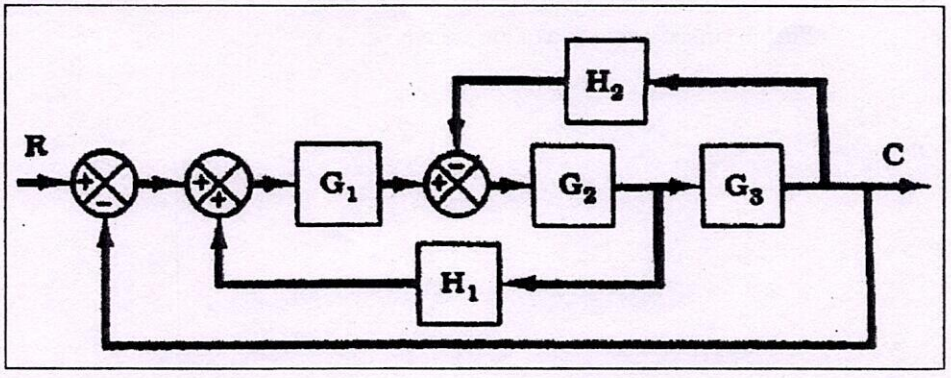
$$s^4 + 2s^3 + 10s^2 + (K-10)s + K = 0$$

(b) Draw and explain the block diagram of a closed-loop traffic light control system. **(5)**

Q3. (a) Draw the root locus for a unity feedback system whose open-loop transfer function is given by: **(5)**

$$G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+20)}$$

(b) Find the overall transfer function $\frac{C}{R}$ for the system described below using the block diagram reduction method. **(5)**



P.T.O.

Q4. (a) The open-loop transfer function of a unity feedback control system is given by: **(5)**

$$G(s)H(s) = \frac{50}{s^2(s+2)(s^2+2s+20)}$$

Determine the steady state error of the system when the inputs are (i) 5 (ii) $5t$ (iii) $\frac{3t^2}{2}$

(b) The open-loop transfer function of a servo system with unity feedback is given by: **(5)**

$$G(s)H(s) = \frac{10}{(s+2)(s+5)}$$

Determine the damping ratio and undamped natural frequency of oscillation. What is the percentage overshoot of the response to a unit step input?

Part-B

Q5. Draw the Bode Plot for open-loop transfer function given as: **(10)**

$$G(s)H(s) = \frac{50}{s(1+0.25s)(1+0.1s)}$$

and determine the gain margin, gain crossover frequency, phase margin, phase crossover frequency and the stability of the system.

Q6. The open-loop transfer function of a unity feedback control system is shown below: **(10)**

$$G(s)H(s) = \frac{60}{(s+1)(s+2)(s+5)}$$

Using Nyquist stability criterion, determine whether the closed-loop is stable or not.

Q7. (a) Explain the design procedure for phase-lead compensators. **(5)**

(b) A system is described by the following equations: **(5)**

$$\dot{x}(t) = \begin{bmatrix} -1 & 1 \\ 0 & -2 \end{bmatrix} x(t) + \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix} u(t) \text{ and } y(t) = \begin{bmatrix} 1 & 2 \\ 1 & 0 \\ 1 & 1 \end{bmatrix} x(t)$$

Find the transfer function of the system.

x-x-x