QP Code : 583401

(3 Hours) [Total Marks :100

N.B. : (1) Question no. **1** is **compulsory**
(2) Attempt any four questions out of remaining six questions.
(3) Assume suitable data if necessary and justify the same.
(4) Write neat and clear

1. Answer the following questions.
    (a) What are advantages and disadvantages of closed loop systems? 5
    (b) State and explain Routh-Hurwitz criterion. 5
    (c) Define controllability and obsorbability. 5
    (d) Draw the nature of response for a second order undamped, underdamped, 5
         overdamped, critically damped and negatively damped system.

2. (a) Find the transfer function C(s)/R(s) for figure 1. Use Mason's gain formula. 10
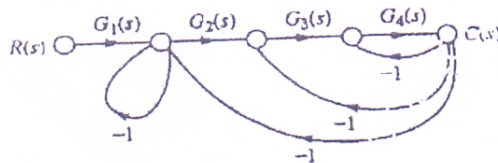
Q 2 (a) Figure 1.

    (b) Find the transfer function relating the capacitor voltage, Vc(s), to the input voltage, 10
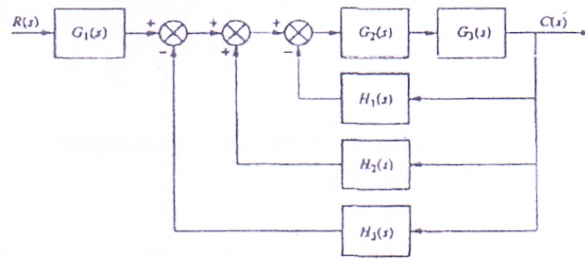   V(s) in Figure 2.
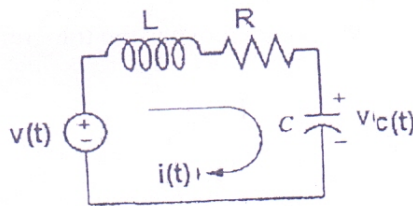
Q 2(b) Figure 2.

3. (a) The forward path transfer functions two of unity feedback system are given below. 10
         Determine the damping ratio and natural frequency of oscillations and nature of
         damping of each system

Con. : 8122-16. [TURN OVER]

(a) $G(s) = (3s + 13) / (s + 3)(s + 4)$

(b) $G(s) = (s + 9) /s (s + 2)$

(b) Find C(s)/R(s) for figure 3. Use block diagram reduction technique.   10

Q 3(b) Figure 3.

4. (a) Find the state-space representation in phase-variable form for the transfer function.   10
    Draw signal flow graph.

$$G(s) = \frac{24}{s^3 + 9s^2 + 26s + 24}$$

(b) A unity feedback system has the following forward transfer function. Evaluate system   10
     type, Kp, Kv, and Ka. Also find the steady-state errors for the standard step, ramp,
     and parabolic inputs

$$G(s) = \frac{1000(s + 8)}{(s + 7)(s + 9)}$$

5 (a) A certain unity negative feedback control system has the transfer function of   10

$$G(s) = \frac{K}{s(s+1)(s+2)}$$

Draw root locus for $0 \le K \le \infty$

(b) How many roots of the following polynomial are in the right half-plane, in the left   10
     half-plane, and on the $j\omega - $ axis :

$$P(s) = s^5 + 3s^4 + 5s^3 + 4s^2 + s + 3$$

Con. : 8122-16.

6. (a) Briefly explain how to determine the static error constants from the Bode magnitude 10
plot.

(b) For given unity feedback system draw Bode magnitude plot. What is gain crossover 10
frequency? Determine position error constant Kp.

$$G(s) = \frac{30000}{(s+2)(s+10)(s+50)}$$

7. Write short note on any **TWO** 20
(a) Co-relation between time and frequency response
(b) Lead, lag, lead-lag compensator
(c) Stepper motor