

Reg. No. :

Question Paper Code : 71451

B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Electronics and Communication Engineering

EC 2255/EC 46/EE 1256 A/080290023/10144 EC 406 — CONTROL SYSTEMS

(Regulation 2008/2010)

(Common to 10144 EC 406 — Control Systems for B.E. (Part – Time)
Third Semester ECE – Regulation 2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the transfer function of the network given in fig. 1.

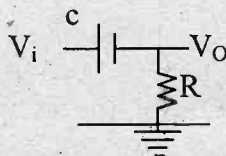


Fig. 1

2. State Mason's gain formula.
3. How do you find the type of a system?
4. Find the unit impulse response of system $H(S) = 5/(s+4)$ with zero initial conditions.
5. What is the use of Nichol's chart?
6. List the advantages and disadvantages of phase lag network.
7. Find the range of K for closed loop stable behavior of system with characteristic equation $4s^4 + 24s^3 + 44s^2 + 24s + K$ using Routh Hurwitz stability criterion.

8. What is the angle of asymptotes in the Root Locus of a system with n poles and m zeros?
9. Define controllability of a system.
10. State Sampling theorem.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the functional blocks of closed loop feedback control system. (6)
- (ii) Derive the transfer function of system shown in fig. 2. (10)

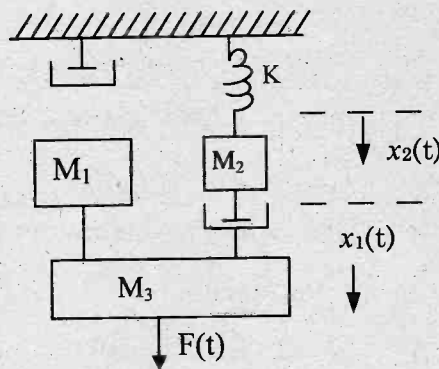


Fig. 2

Or

- (b) Find the transfer function of the system shown in fig. 3 using block diagram reduction technique and signal flow graph technique.

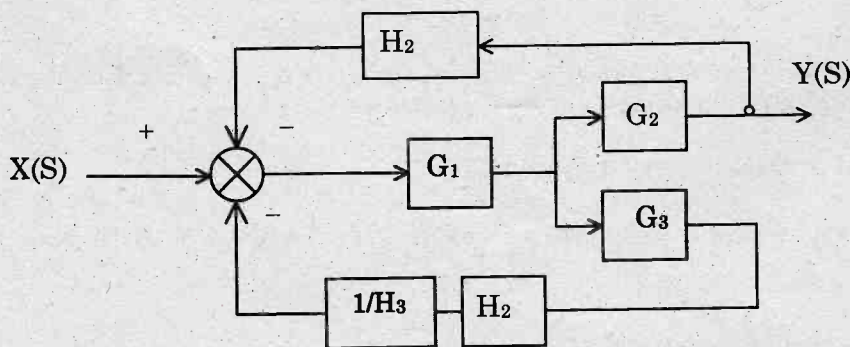


Fig. 3

12. (a) (i) For the system shown in figure 4. find the error using dynamic error coefficient method for input $r(t) = 5 + 4t + 7t^2$.

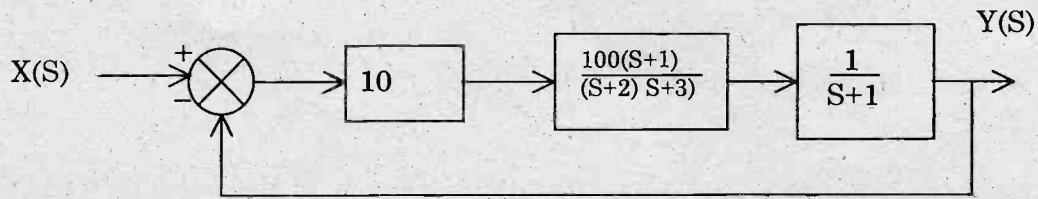


Fig. 4

- (ii) Briefly discuss about transient response specifications.

Or

- (b) (i) For the system shown in fig. 5. find the effect of PD controller with $T_d = 1/10$ on peak overshoot and settling time when it is excited by unit step input.

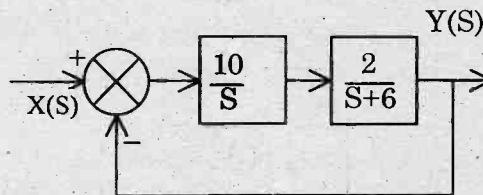


Fig. 5

- (ii) Discuss the effect of PI controller in the forward path of a system.

13. (a) A robotic arm has a joint control loop transfer function $G_c(s)G(s) = \frac{300(s+100)}{s(s+10)(s+40)}$. Prove that the frequency equals 28.3 rad/s when the phase angle is -180° . Find the magnitude at that frequency.

Or

- (b) Derive the transfer function of the compensating network and the type of compensation given in figure 6 and draw the Bode plot.

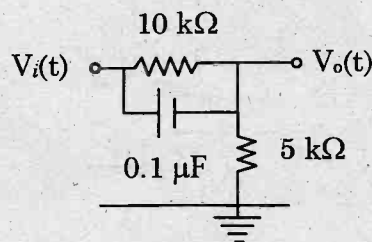


Fig. 6

12. (a) (i) For the system shown in figure 4. find the error using dynamic error coefficient method for input $r(t) = 5 + 4t + 7t^2$.

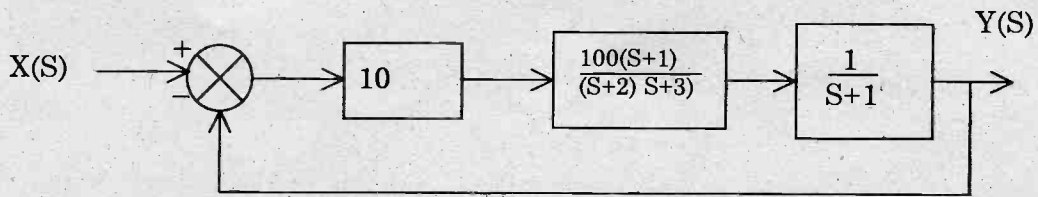


Fig. 4

- (ii) Briefly discuss about transient response specifications.

Or

- (b) (i) For the system shown in fig. 5. find the effect of PD controller with $T_d = 1/10$ on peak overshoot and settling time when it is excited by unit step input.

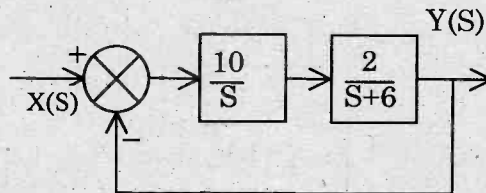


Fig. 5

- (ii) Discuss the effect of PI controller in the forward path of a system.

13. (a) A robotic arm has a joint control loop transfer function $G_c(s)G(s) = \frac{300(s+100)}{s(s+10)(s+40)}$. Prove that the frequency equals 28.3 rad/s when the phase angle is -180° . Find the magnitude at that frequency.

Or

- (b) Derive the transfer function of the compensating network and the type of compensation given in figure 6 and draw the Bode plot.

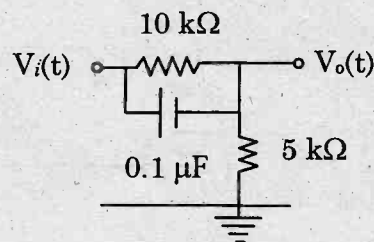


Fig. 6

14. (a) A single loop negative feedback system has a loop transfer function $G_c(s)G(s) = \frac{k(s+2)^2}{s(s^2+1)(s+8)}$. Sketch the root locus as a function of K. Find the range of K for which the system is stable. K for which purely imaginary roots exist and find the roots.

Or

- (b) Draw the Nyquist plot and find the stability of the following open loop transfer function of unity feedback control system. $G(s)H(s) = K(s+4)/(s^2(s+2))$ If the system is conditionally stable, find the range of K for which the system is stable.
15. (a) Consider a system with state-space model given below.

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 4 \end{bmatrix} u; y = [2 \quad -4 \quad 0]x + (0)u$$

Verify that the system is observable and controllable.

Or

- (b) Explain the functional modules of closed loop sampled data system, and compare its performance with open loop sampled data system.