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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.

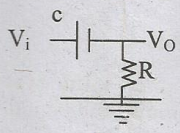

Fig. 1

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)

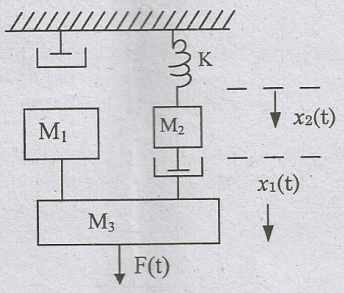

Fig. 2

Or

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

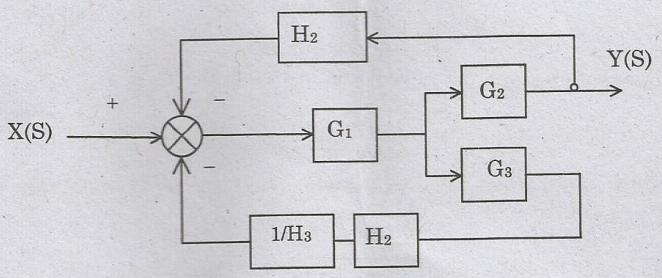

Fig. 3

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

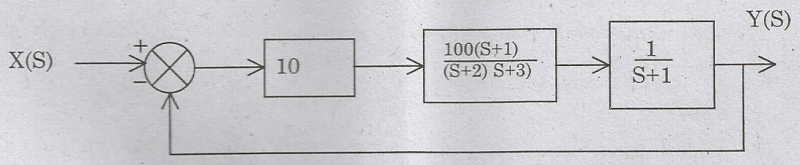

Fig. 4

(ii) Briefly discuss about transient response specifications.

Or

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

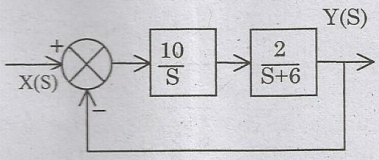

Fig. 5

(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.

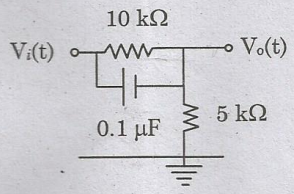

Fig. 6

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.

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

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.

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