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Question Paper Code : 50957

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Third Semester

Electronics and Communication Engineering

EC 3351 — CONTROL SYSTEMS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the properties of signal flow graph?

2. List the basic components of block diagram.

3. Define peak over shoot.

4. A unity feedback system has an open loop transfer function of $G(s)=\frac{12}{(s+1)(s+6)}$. Determine the steady state error for unit step input.

5. Define phase margin.

6. List the advantages of bode plot.

7. Define Relative stability.

8. What is centroid of root locus? How the centroid is computed?

9. What are the characteristics of lead compensation? when is the lead compensation employed?

10. Draw the frequency plot of lag compensator.

PART B — (5 × 13 = 65 marks)

11. (a) Determine the transfer functions $X_1(s)/F(s)$ and $X_2(s)/F(s)$ for system shown in figure 1.

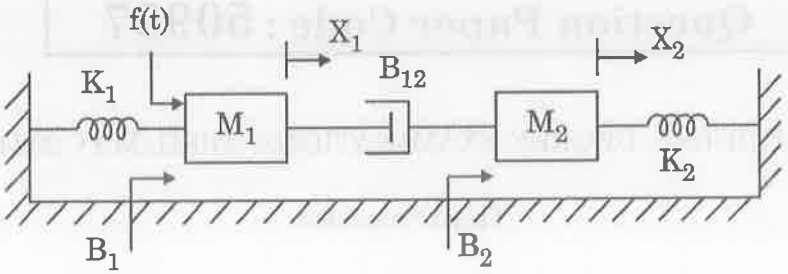

Fig. 1

Or

(b) (i) Derive an expression for the transfer function of armature controlled DC motor system with necessary diagram. (8)

(ii) Discuss in details about multivariable control system with suitable diagram. (5)

12. (a) (i) Elucidate the analytical design for PI control system. (8)

(ii) The damping ratio of the system is 0.75 and the natural frequency of oscillation is 12 rad/sec. Determine peak overshoot and settling time. (5)

Or

(b) With neat diagram, explain about analog PID controller and derive its output equation. (13)

13. (a) The open loop transfer function of the system, $G(s)=\frac{20}{s(3s+1)(4s+1)}$. Sketch the bode plot and obtain the value of gain cross over frequency. (13)

Or

(b) An unity feedback system having an open loop transfer function, $G(s)=\frac{1}{s(s+1)(s+0.5)}$. Sketch the polar plot and determine the value of gain margin and phase margin. (13)

14. (a) (i) The open loop transfer function of feedback control system is given by $G(s)=\frac{K}{s(s+2)(s+1)}$. Using Routh criterion, determine the range of K and frequency of oscillation of the system. (8)

(ii) Discuss the concept of BIBO stability. (5)

Or

(b) The open loop transfer function of unity feedback system is given below. $G(s)=\frac{K}{s(s+2)(s+4)}$. Sketch the root locus plot for the above system and determine the value of K. (13)

15. (a) (i) Construct a state model for the system described by the differential equation, $\frac{d^3y}{dt^2}+6\frac{d^2y}{dt}+11\frac{dy}{dt}+6y+u=0$. Also draw the block diagram representation of the state model. (8)

(ii) Discuss the solution of homogeneous state equation. (5)

Or

(b) A discrete time system described by the difference equation, $Y(k+2)+5y(k+1)+6y(k)=u(k)$ and initial conditions $y(0)=y(1)=0$; $T=1s$. Determine the state model in canonical form. Also compute the state controllability of the above discrete time system. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Design a lead compensator for a unity feedback system with open loop transfer function, $G(s)=\frac{K}{s(s+1)(s+5)}$ to satisfy the following specifications

(i) Velocity error constant, $Kv \geq 50$ and

(ii) Phase margin is ≥ 20. (15)

Or

(b) (i) Derive the transfer function of armature controlled DC servo motor system. (7)

(ii) Find the transfer function $C(s)/R(s)$ for the signal flow graph shown in figure. (8)

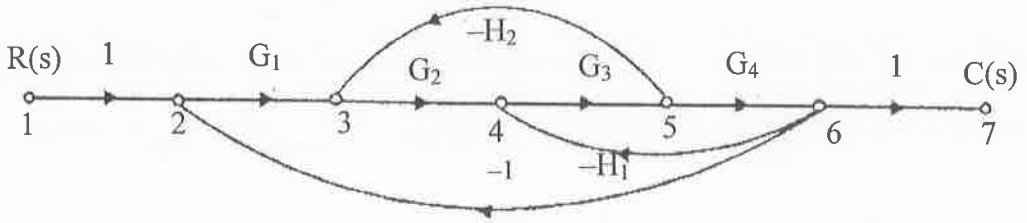

Fig. 2