Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 70434

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fourth Semester

Electronics and Communication Engineering

EC 6405 – CONTROL SYSTEM ENGINEERING

(Common to Mechatronics Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

(Provide Semilog sheet, Polar graph and ordinary graph sheet)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. List the advantages of Closed loop System?

2. What is Block diagram? What are its basic components?

3. List the standard test signals used in time domain analysis.

4. State the effect of PI compensation in system performance.

5. What is the use of Nichol's chart?

6. What are the characteristics of phase lead network?

7. What are the advantages of Routh Hurwitz stability criterion?

8. Define Nyquist stability criterion.

9. List the main properties of a state transition matrix

10. State sampling theorem.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the features of closed loop feedback control system. (3)

(ii) Derive the transfer function of system shown in fig. 11(a) (ii). (10)

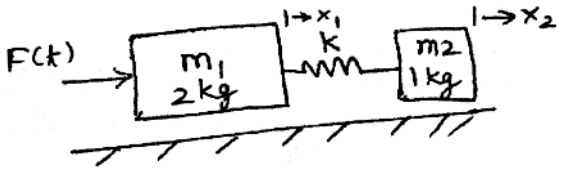

Fig. 11(a) (ii)

Or

(b) Find the transfer function of the system shown in fig. 11(b) using block diagram reduction technique and signal flow graph technique.

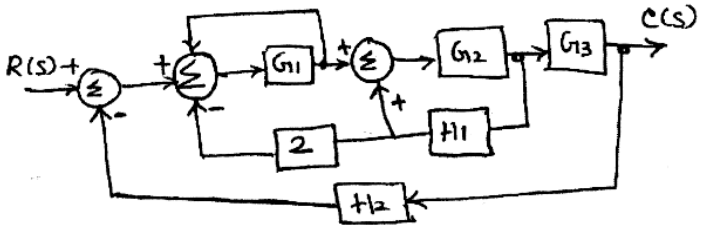

Fig.11(b)

12. (a) (i) Derive the time response analysis of a first order system for step and ramp input. (10)

(ii) What are the time domain specifications? Define any two. (3)

Or

(b) (i) Determine the type and order of the system with following transfer functions.

(1) $\dfrac{S+4}{(S-2)(S+3)}$

(2) $\dfrac{10}{S^3(S^2+2S+1)}$ (3)

(ii) With a neat diagram, explain the function of pin compensation in detail. (10)

13. (a) The open loop transfer function of a unity feedback system is given by $G(s)=1/s\left[s(1+s)^2\right]$. Sketch the polar plot and determine the gain and phase margin. (13)

Or

(b) (i) Write down the procedure for designing Lag compensator using Bode plot. (10)

(ii) State about Parallel feedback compensation. (3)

14. (a) Determine the range of K for stability of unity feedback system using Routh stability criterion whose transfer function.

$$\frac{C(s)}{R(s)}=\frac{K}{s\left(s^2+s+1\right)(s+2)+K}$$

Or

(b) Explain briefly about the steps to be followed to construct a root locus plot of a given transfer function.

15. (a) (i) Construct a state model for a system characterized by the differential equation $\left(d^3y/dt^3\right)+6\left(d^2y/dt^2\right)+11(dy/dt)+6y+u=0$.(7)

(ii) With the neat block diagram explain the sampled data control system and state its advantages. (6)

Or

(b) Test the controllability and observability of the system by any one method whose state space representation is given as (13)

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 0 & 1\\ -2 & -3 & 0\\ 0 & 2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 2\\ 0\end{bmatrix}\text{u; y=}\begin{bmatrix}1 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

PART C — (1 × 15 = 15 marks)

16. (a) Using Manson's gain formula, obtain the transfer function of the given signal flow graph in fig.16(a).

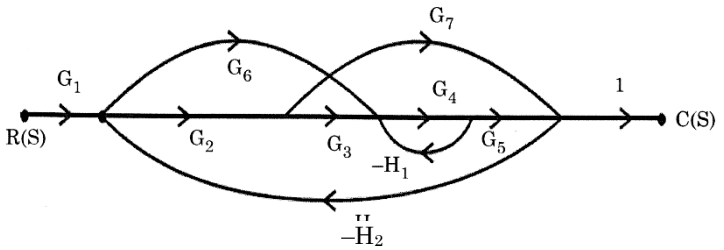

fig.16(a)

Or

(b) Using Nyquist stability criterion, find the relative stability of the system whose open loop transfer function is defined as $G(s)H(s)=\frac{K(s+1)}{s^2\left(s^2+2\right)(s+4)}$.

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