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

Question Paper Code : 70084

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

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 — ($10 \times 2 = 20$ marks)

1. Define the transfer function of the system.

2. Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system.

3. Define order of the system.

4. Mention the effect of PD controller on system performance.

5. What are the Frequency domain specifications?

6. For a stable system the gain margin and phase margin should be positive. Justify your answer.

7. What do you mean by relative stability?

8. State Routh's criterion for stability.

9. What is state transition matrix?

10. Write the advantages of state space modeling?

PART B — (5 × 13 = 65 marks)

11. (a) Determine the transfer function, $\frac{X_1(S)}{F(S)}$ and $\frac{X_2(S)}{F(S)}$ for the system shown in following fig Q.11(a).

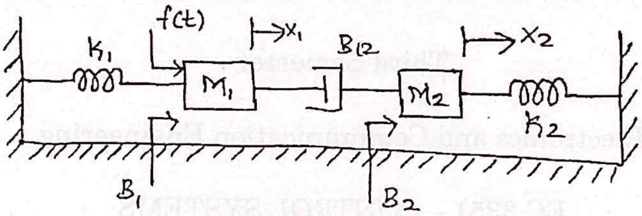

Fig Q 11(a)

Or

(b) (i) By using block diagram reduction technique find, $\frac{C(S)}{R(S)}$.

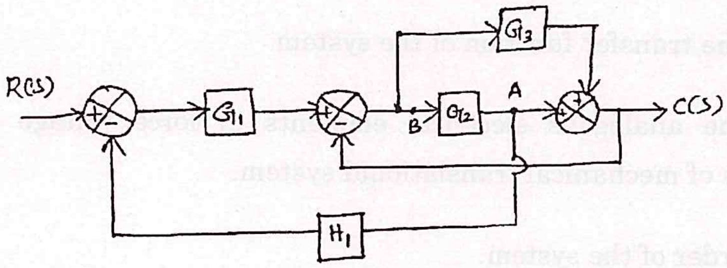

Fig Q 11(b) (i)

(ii) Find the T.F. for the following SFG using Mason's gain formula.

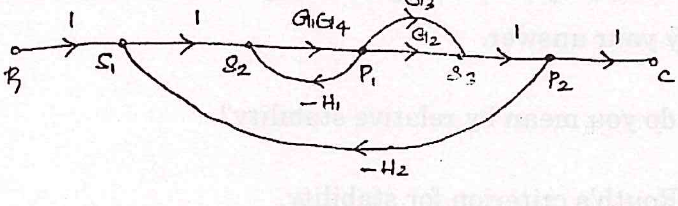

Fig 11(b) (ii)

12. (a) The unity feedback system is characterised by an open loop transfer function, $G(S)=\frac{K}{s(s+10)}$. Determine the gain K, so that the system will have a damping ratio of 0.5 this value of K. Determine settling time, peak overshoot and time at peak overshoot for a unit step input.

Or

(b) The open loop transfer of a feedback control system with unity feedback is given by, $G(S)=\frac{40}{s(1+0.5\ s)}$. Determining the error constants for the system. Also obtain the steady state error when the input is $r(t)=1+5t+5t^2$.

13. (a) Draw the Bode plot for the open loop transfer function, $G(S)\ H(S)=\frac{20s^2}{(1+0.2s)\ (1+0.02\ s)}$ and determine the gain cross over frequency and phase cross over frequency of the system.

Or

(b) Draw the electrical equivalent circuit of Lag compensator and obtain its transfer function. Also, explain the design procedure of lag compensator.

14. (a) The open loop transfer function of a unity feedback system is given by, $G(S)=\frac{k(s+3)}{s(s+2)\ (s+7)}$. Find the range of a K for stable system.

Or

(b) The open loop transfer function of a unity feedback system is given by, $G(S)=\frac{K(s+9)}{s(s^2+4s+11)}$ Sketch the root locus of the system.

15. (a) Obtain state space representation for system, $y''+3y'+2y=0$. Also find the state transition matrix $\varphi(t)$.

Or

(b) Check the controllability and observability for the system described by,

$$x=\begin{bmatrix}0 & 6 & -5\\ 1 & 0 & 2\\ 3 & 2 & 4\end{bmatrix}x+\begin{bmatrix}0\\ 1\\ 2\end{bmatrix}u \quad y=\begin{bmatrix}1 & 2 & 2\end{bmatrix}x.$$

PART C — (1 × 15 = 15 marks)

16\. (a) Sketch the polar plot for the given unity feedback system having an open loop transfer function $G(S)=\frac{k}{s(1+0.2s)(1+0.1s)}$ and also determine K so that phase margin is 60°.

Or

(b) Explain the significance of controller and mention its types and also the design procedure for PID controller in feedback control system.
