EC/EE 311 (R-15)

Total No. of Questions :09] [Total No. of Pages : 03

III/IV B.Tech. (Supple) DEGREE EXAMINATIONS, JUNE- 2019

First Semester

EC/EE

LINEAR CONTROL SYSTEMS

Time: Three Hours **Maximum marks:60**

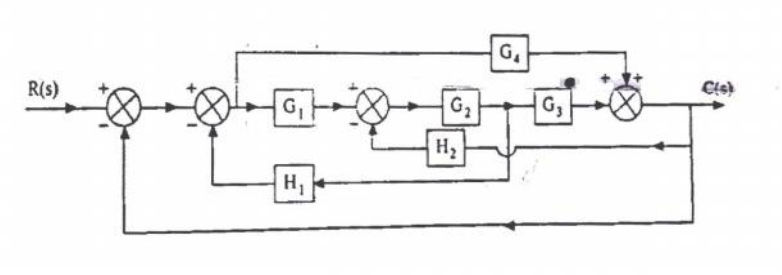
Answer Question No.1 Compulsory **12X1=12 M**

Answer ONE Question from each Unit **4X12=48 M**

1. a) Define system, control system
   b) Distinguish between linear and nonlinear control system
   c) State disadvantages and advantages of signal flow graph
   d) Define the term raise time, settling time.
   e) What are the conditions of Routh Hurwitz criteria of stability?
   f) What is the purpose of Nyquist plots.
   g) Define Phase margin, gain margin
   h) State the importance of state transmission matrix.
   i) Define conditionally stable system.
   j) Define angle of departure, angle of arrival
   k) Define bandwidth frequency
   l) What is PID controller?

UNIT-I

2. a) Draw the signal flow graph and derive the transfer function of the system using mason's gain formula.

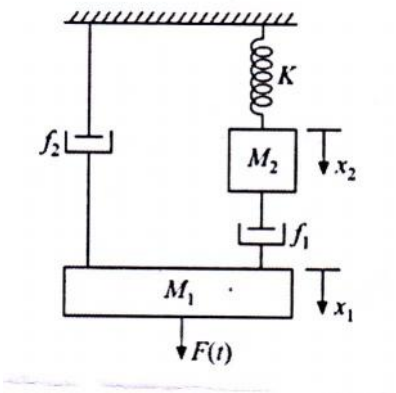


   b) Obtain the transfer function Armature controlled DC motor.

P.T.O

(OR)

3. a) Write the differential equations for mechanical system shown in figure and obtain an analogous electrical circuit in force-voltage analogy.



b) Explain the working principle of synchro transmitter.

UNIT-II

4. a) Write the expression for time domain specification of a second order control system and indicate with neat sketch? Also how damping ratio affect the time response of second order system.

b) Determine the range of K for stability

$S^3 + 2S^4 + 3S^3 + 4S^2 + K(S+1) + S + 5 = 0$ for K>0.

(OR)

5. a) Determine the stability of system represented by the characteristic equation $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$ by means of Routh criterion.

b) Determine the step, ramp and parabolic error constant for the following system with unity feedback.

i) $G(s) = \dfrac{K}{s(s^2 + 4s + 200)}$ ii) $G(s) = \dfrac{100}{s(1+0.1s)}$

UNIT-III

6. Sketch the bode plot for the transfer function and determine the system gain K for which the gain cross over frequency w_c to be 5 rad/sec.

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$$

P.T.O

(OR)

7. a) What are the advantages of frequency domain analysis?

   b) State and explain Nyquist stability criterion to determine the stability of a system?

UNIT-IV

8. Sketch the complete root locus for the system having

$$G(S)H(S)=\frac{K}{S(S+3)(S^2+3S+4.5)}$$

Determine the range of K for which the system is stable.

(OR)

9. a) Obtain the state space representation of the system whose differential equation is given by $Y_3+2Y_2+3Y_1+6Y_0=U_2-U_1+2U_0$

   b) Find the Eigen value and Eigen vectors of the system represented by state space matrix A. Also derive a diagonal matrix of the system.

$$A=\begin{vmatrix}1 & 1 & 2\\ 0 & 2 & 0\\ 0 & 0 & 2\end{vmatrix}$$

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III/IV B.Tech. (Supple) DEGREE EXAMINATIONS, JUNE- 2019

First Semester

EC/EE

LINEAR CONTROL SYSTEMS

Time: Three Hours **Maximum marks:70**

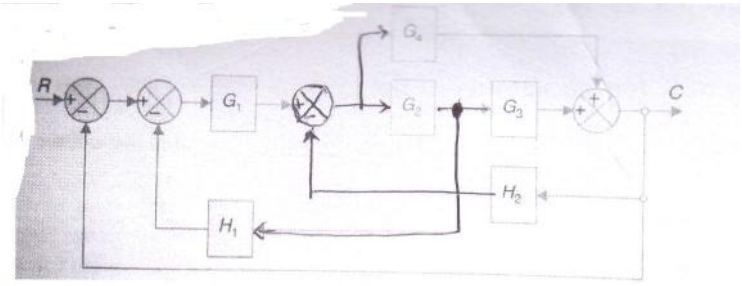
Answer Question No.1 Compulsory **14X1=14 M**

Answer ONE Question from each Unit **4X14=56 M**

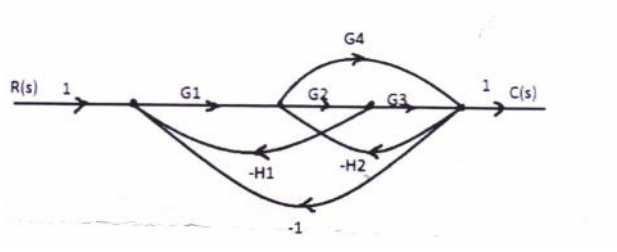
1. a) What are the limitations of transfer function approach?
   b) State disadvantages of the block diagram reduction technique?
   c) Define critical damped system?
   d) Define conditionally stable system?
   e) Write a note on angle of departure, angle of arrival
   f) What are the advantages of Negative Feedback?
   g) What are different types of Controller?
   h) Define Dominant Poles
   i) What are the advantages of Bode Plots?
   j) Define Controllability
   k) What is zero input stability
   l) What are Compensating networks?
   m) Write the significance of root locus?
   n) What is damping factor?

UNIT-I

2. a) Obtain the transfer function of the closed loop control system shown in figure using block body reduction technique.

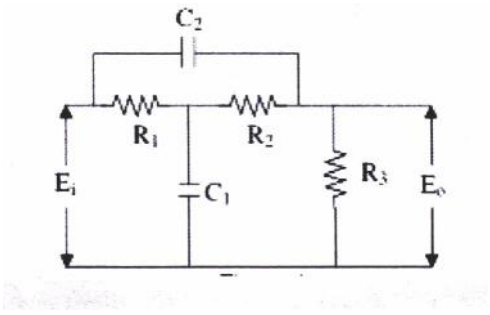


b) Deduce the transfer function of signal flow graph shown in figure using Masson's gain formula.



(OR)

3. a) Obtain $\frac{E_0(s)}{E_i(s)}$ of the below electrical system shown in figure



b) Explain the working of Synchronous transmitter and receiver pair

UNIT-II

4. a) Write the expression for time domain specification of a second order control system and indicate with neat sketch? Also how damping ratio affect the time response of second order system.

b) Determine the step, ramp and parabolic error constant for the following system with unity feedback.

i) $G(s)=\frac{K}{S(S^2+4S+200)}$ (ii) $G(s)=\frac{100}{S(1+0.1S)}$

(OR)

5. a) Using Routh-Hurwitz Criteria comment on the stability of given system represented by characteristic equation $2s^6+2s^5+3s^4+3s^3+2s^2+s+1=0$. Find the number of roots in the right half of S-plane. **P.T.O**

b) Find the range of K for the stability of the system with characteristic equaiton $S^4+3S^3+3S^2+2S+K=0$ by Routh-Hurwitz criterion.

UNIT-III

6. a) What are the advantages of frequency domain analysis over time domain analysis? explain

b) Draw the Bode plot and obtain gain and phase cross over frequency of the transfer function $G(s)=\dfrac{20}{s(1+3s)(1+4s)}$

(OR)

7. a) Explain the Nyquist stability criteria. What are the advantages of Nyquist plots?

b) Determine the stability of system $G(s)H(s)=\dfrac{5}{S(1+0.2S)(1+S)}$ using stability criteria and draw the plot.

UNIT-IV

8. a) Construct state model for the following differential equation $3y_4+5y_3+6y_2+7y_1+4y_0=3u_0$

b) Determine the state controllability and Observability of the system using Kalman's test.

$$A=\begin{bmatrix}-1 & 1 & 0\\ 0 & -1 & 1\\ 0 & 0 & 1\end{bmatrix} \quad B=\begin{bmatrix}0\\1\\1\end{bmatrix} \quad C=\begin{bmatrix}1 & 0 & 1\end{bmatrix}$$

(OR)

9. a) Discuss the effect of adding pole or zero on time domain specification of control system in detail?

b) Sketch the root locus for the unity feedback system whose open loop transfer function is

$$G(s)H(s)=\frac{K}{s(s+4)(s^2+4s+20)}$$