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

III/IV B.Tech. DEGREE EXAMINATIONS, NOVEMBER- 2019

First Semester

EC/EE

LINEAR CONTROL SYSTEMS

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

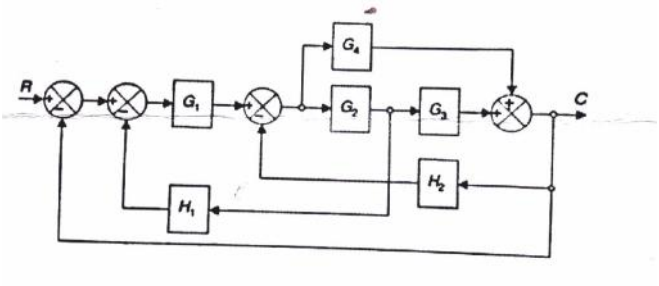
Answer Question No.1 Compulsory **12X1=12 M**

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

1. a) What are the advantages of negative feedback?
   b) What are different types of controller?
   c) Define gain and phase margin
   d) Define dominant poles
   e) What are the advantages of bode plots?
   f) Define state transition matrix
   g) Define controllability
   h) What are the test signals?
   i) Define BIBO stability
   j) What is conditionally stable system
   k) Define routhhurwitzpolynomial
   l) What is peak overshoot

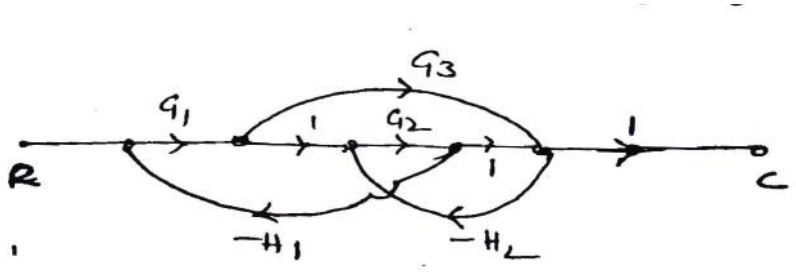
UNIT-I

2. a) Derive the transfer function and block diagram for speed control of DC servo motor?
   b) Obtain the transfer function of the closed loop control system shown in fig. using the block body reduction technique.



(OR)

3. a) Find the transfer function of the signal flow graph shown in fig. using the mason's gain formula.



b) Derive the expression for peak, rise time in iterms of ¶ and ω_n for a second order control system.

UNIT-II

4. a) A unity feedbacl system is characterized by a 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. For this value of K determine settling time, peak overshoot, and time to peak overshoot for unit step input.

b) Find all steady state errors for open loop transfer function with unity feed back given by $G(s) = \frac{10}{s(0.1s+1)}$

(OR)

5. a) A unity feedback system is characterized by the open loop transfer function $G(s) = \frac{1000}{s^2(s+1)(s+20)}$. Determine the steady state error for unit-step, unit-ramp and unit acceleration inputs. Also determine the damping ratio and natural frequency of dominant roots?

b) Consider a sixth order system with character equation

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$

Find the stability of the system using Routh's test and comment on nature of roots?

UNIT-III

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

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.05s)}$$

(OR)

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

   b) Explain the Nyquist Criterion for closed loop control system.

UNIT-IV

8. Sketch the root locus for the unity feedback system whose open loop transfer function is $G(s) = \frac{K}{s(s^2+6s+10)}$. Also determine range of 'K'?

(OR)

9. a) Write a short note on advantages and limitations of state variable approach.

   b) Find the transfer function of the systems with following state model

$$X = \begin{bmatrix} 0 & 1 \\ 1 & -4 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} U, Y = \begin{bmatrix} 1 & 0 \end{bmatrix} X$$

   Also determine the system is controllable.

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**

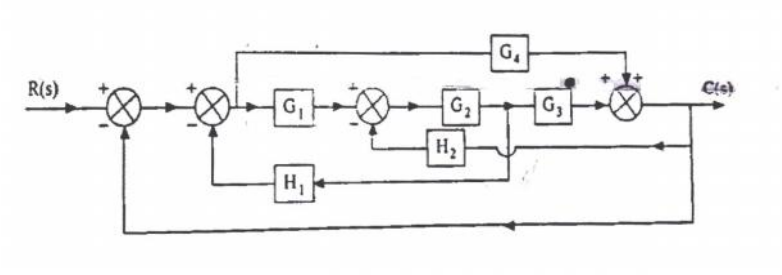
Answer Question No.1 Compulsory **12X1=12 M**

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.

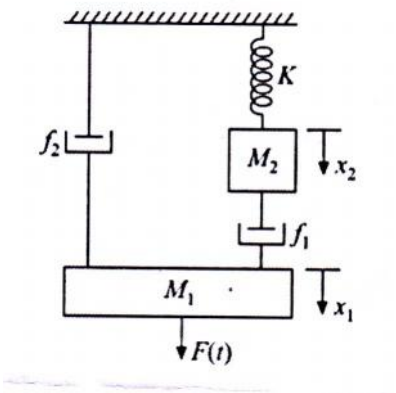


   b) Obtain the transfer function Armature controlled DC motor.

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.

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

EC/EE 311 (R-15)

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

III/IV B.Tech. DEGREE EXAMINATIONS, NOV/DEC-2018

First Semester

EC/EE

LINEAR CONTROL SYSTEMS

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

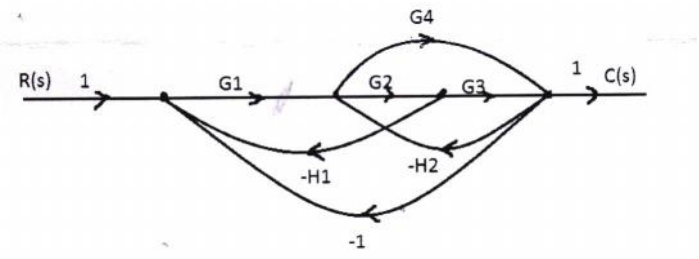
Answer Question No.1 Compulsory **12X1=12 M**

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

1. a) What are the limitations of transfer function approach?
   b) State the applications of AC servo motor.
   c) State disadvantages of the block diagram reduction technique.
   d) Define critical damped system.
   e) Define steady state response and steady error.
   f) Discuss the advantage of feedback in a control system
   g) Define relative stability
   h) State the advantages of Routh's method.
   i) Define terms asymptotes and centroid.
   j) What are the standard test signals?
   k) What is compensating network?
   l) What are the limitations of time domain analysis?

UNIT-I

2. a) Obtain the C(s)/R(s) for the flow graph show in Figure using the Mason's gain formula.

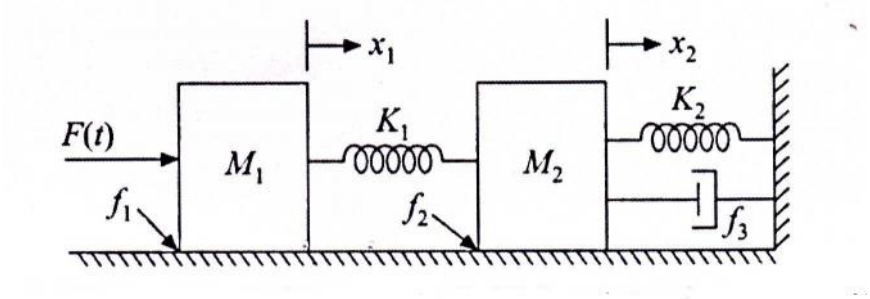


   b) Explain the working of an AC servo motor and discuss its applications.

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) Determine the transfer function of Field controlled DC motor and draw the block diagram.

UNIT-II

4. a) Draw the step response of second order system and indicate all time domain specifications?

b) A unity feedback system is characterized by the open loop transfer function $G(s)=\frac{1000(s+1)}{(s+10)(s+50)}$. Determine the steady state error for unit-step, unit-ramp and unit acceleration inputs. Also determine the damping ratio and natural frequency of dominant roots?

(OR)

5. a) What are the necessary condition to have all roots of the characteristic equation in the left hand of s-plane?

b) Determine the stability of the system represented by the characteristic equations $s^5+s^4+s^3+9s^2+16s+10=0$, also determine the number of roots on the right half s-plane?

UNIT-III

6. Sketch the bode plots showing the magnitude in dB and phase angle in degrees of $G(s)=\frac{10}{s(1+0.5s)(1+0.02s)}$. Determine the gain cross over frequency, phase cross over frequency and margins?

P.T.O

(OR)

7. a) State and Explain Nyquist stability criterion to determine the stability of a system.

   b) What are compensating network? Explain about lead, lag networks?

UNIT-IV

8. a) State and Explain Nyquist stability criterion to determine the stability of a system?

   b) Sketch the polar plot and determine gain margin and phase margin for open loop transfer function of unity feedback system $G(s)=\frac{1}{s(s+2)(s+4)}$

(OR)

9. a) Obtain state variable representation of a field control DC motor?

   b) Determine whether the following system is completely state controllable and observable using Kalman's test?

$$A=\begin{vmatrix} 0 & 1 & 1 \\ 0 & 0 & 1 \\ -1 & -3 & -3 \end{vmatrix} \quad B=\begin{vmatrix} 0 \\ 0 \\ 1 \end{vmatrix} \quad C=\begin{bmatrix} 0 & 1 & -1 \end{bmatrix}$$

EE 311 (R-15)

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

III/IV B.Tech. DEGREE EXAMINATIONS, JUNE/JULY-2018

First Semester

ELECTRICAL & ELECTRONICS ENGINEERING

LINEAR CONTROL SYSTEMS

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

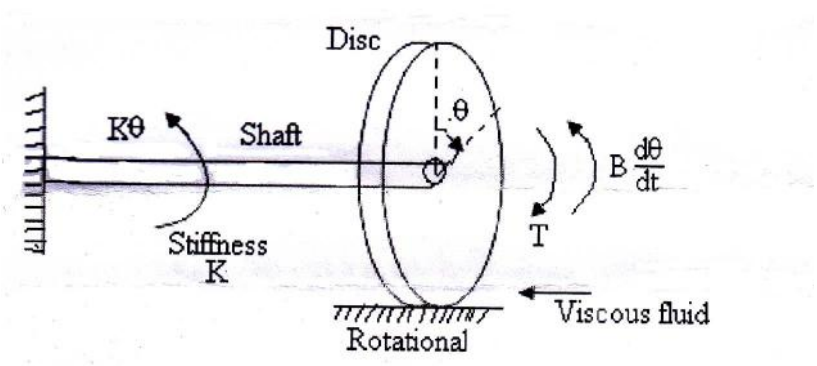
Answer Question No.1 Compulsory **12X1=12 M**

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

1. a) Define Transfer function
   b) Define Mathematical model
   c) Define feedback control system
   d) Define ramp signal
   e) Define synchro transmitter & Receiver
   f) Define first order systems
   g) Define zero input-output stability
   h) What is the difference between time and frequency responses
   i) What is PID controller.
   j) Define state variable
   k) Define Controllability
   l) Define State equation.

UNIT-I

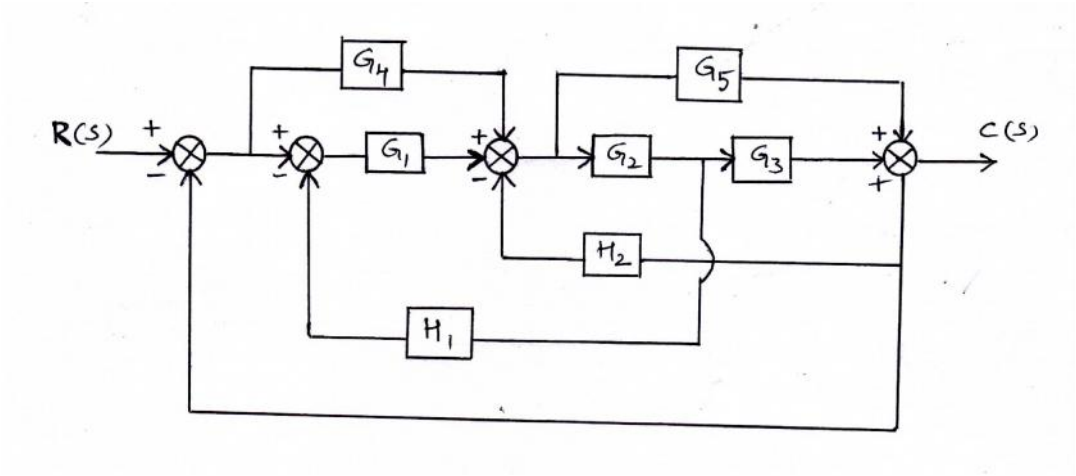
2. a) Explain the advantages and features of transfer function.
   b) Derive the transfer function for the following rotational mechanical systems shown in the figure.



(OR)

3. a) Explain the operation of Synchro transmitter and receiver pair and mention its applications.

   b) Determine the transfer function C(S)/R(S) for the block diagram shown in Fig below.



UNIT-II

4. a) Derive the expression for rise time, peak over shoot, settling time of 2nd order system of unit step input.

   b) A unit feedback system is characterized by an open-loop transfer function $G(s) = \frac{K}{s(s+5)}$. Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine settling time, peak overshoot and times to peak overshoot for a unit-step input.

(OR)

5. a) A unity feedback system has a forward path transfer function $G(s) = \frac{K(S+13)}{S(S+3)(S+7)}$ using R-H criterion, find the range of 'K' for which the closed loop system is stable.

   b) Derive the expression for overshoot, risetime, band width.

P.T.O

UNIT-III

6. a) Explain the concept of phase margin and gain margin in frequency domain.

   b) Sketch the Bode Plot for $G(s)=\frac{(1+100s)(1+s)}{(1+10s)(1+0.1s)}$. Assume unity feedback. Obtain gain margin and phase margin.

(OR)

7. A unity feedback control system has an open loop transfer function given by $G(S)H(S)=\frac{100}{(S+5)(S+2)}$. Draw the Nyquist diagram and determine its stability

UNIT-IV

8. a) Sketch the root locus plot of a unity feeb-back system whose open loop transfer function is given as $G(S)=\frac{s}{(s+2)(s^2+4)}$

   b) What is compensation? What are the different types of compensators?

(OR)

9. a) For the given system X' = AX + BU, where $A=\begin{bmatrix}1 & 2 & 1\\ 0 & 1 & 3\\ 1 & 1 & 1\end{bmatrix}, B=\begin{bmatrix}1\\0\\1\end{bmatrix}$, test the controllability or not.

   b) Given $\dot{x}(t)=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}0\\1\end{bmatrix}u(t)$, find the unit step response when $x(0)=\begin{bmatrix}1\\1\end{bmatrix}$.