EE/EC/EI 312 (CR)

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

III/IV B.Tech. DEGREE EXAMINATIONS, NOV/DEC-2017

First Semester

EC/EE/EI/IE

LINEAR CONTROL SYSTEMS

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

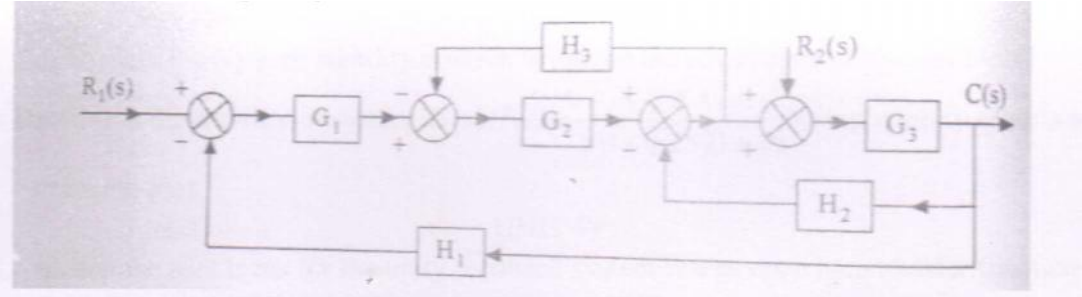
Answer Question No.1 Compulsory **14X1=14 M**

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

1. a) What are the 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 limitations of time domain analysis?
   i) What are the test signals?
   j) Define bibo stability?
   k) What is conditionally stable system?
   l) Define routh hurwitz polynomial?
   m) What is peak overshoot?
   n) Define bandwidth?

UNIT-I

2. a) Find the transfer function $C(s)/R_1(s)$, $C(s)/R_2(s)$ in figure using signal flow graph technique and assume that only one input is present in each case?

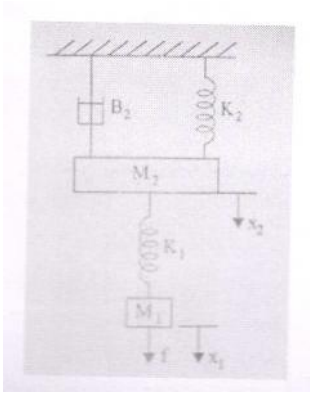


P.T.O

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

(OR)

3. a) Write the differential equations govering the behavior of the mechanical system shown in figure. Also draw signal flow graph?



b) Explain the principle and operation of synchro transmitter and receiver?

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 $G(s)=\frac{100(s+1)}{(s+10)(s+50)}$. 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 conditions 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 equation $s^5+s^4+s^3+9s^2+16s+10=0$, also determine the number of roots on the right half s-plane?

UNIT-III

6. a) State the advantages and limitations of frequency domain approach?

b) Draw the bode plot and find the gain margin and phae margin of system represented by $G(s)H(s)=\frac{10(S+1)}{S(S+0.05)(S+3)(S+5)}$.

P.T.O

(OR)

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

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

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 system 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.

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III/IV B.Tech. DEGREE EXAMINATIONS, APRIL/MAY- 2017

First Semester

EC/EE/EI

LINEAR CONTROL SYSTEMS

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

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

Answer One Question from each Unit. **4X14=56 M**

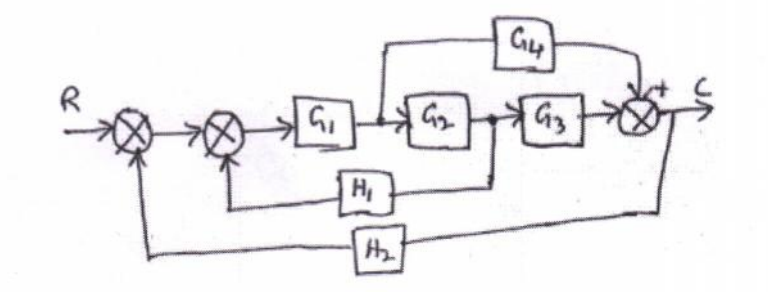
1. Write a short notes on the following:
   a) Define open-loop and closed-loop systems.
   b) What are the characteristics of a negative feedback.
   c) Define the Stability of a system.
   d) What is meant by rise time.
   e) What is corner frequency
   f) State Nyquist stability criterion
   g) Define Gain and phase margin
   h) What are the various time domain specifications?
   i) What is meant by dominant pole?
   j) What is the value of gain K at any given point on root locus?
   k) Explain the concept of controllability.
   l) Define observability of a system.
   m) List the advantages of bode plots
   n) What is a state?

UNIT-I

2. a) Derive an expression for the transfer function of controlled DC servo motor.
   b) Compare in detail about Block diagram and signal flow graph methods.

(OR)

3. a) State and explain the Mason's gain formula.
   b) Find the gain of the system using signal flow graph approach for a given block diagram.as shown in figure below.



P.T.O

UNIT-II

4. a) Obtain the time response of a first order system for a unit step input and plot its response.

   b) A system has $G(s)H(s) = \dfrac{K}{s(s+2)(s+4)(s+8)}$ where K is positive. Determine the range of K for stability.

(OR)

5. a) Derive the time domain specifications of second order system with ramp input.

   b) Explain the special cases in Rouths-stability criterion.

UNIT-III

6. a) Explain the procedure to determine the gain margin and phase margin of a system from its Bode plot?

   b) A feedback system has $G(s)H(s) = \dfrac{100(s+4)}{(s+0.5)(s+10)}$ Draw the Bode plot and comment on stability.

(OR)

7. a) Discuss the calculation of gain crossover frequency and phase crossover frequency with respective to the polar plots.

   b) Derive the correlation between time domain and frequency domain specifications.

UNIT-IV

8. a) Explain the concepts of state, state variables and state model.

   b) Determine the state model of the system characterized by the differential equation

   $$(s^4 + 2s^2 + 8s^3 + 4s + 3)Y(s) = 10U(s)$$

(OR)

9. Write short notes on the following:

   a) Controllability and observability

   b) State transition matrix

   c) Diagonalisation

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III/IV B.Tech. DEGREE EXAMINATIONS, NOV/DEC-2017

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 System
   b) Define Stability
   c) Define Non-linear control system
   d) Define state model
   e) Define characteristic equation
   f) Define BIBO stability
   g) Write the conditions of Hurwitz criterion
   h) What is Dominant pole
   i) Define open loop control system
   j) Define Rootloci
   k) Define Conditional stability
   l) Define Observability

UNIT-I

2. a) Explain and derive the relation between impulse response and transfer function.
   b) Obtain the transfer of the mechanical network shown in Figure 1(b)

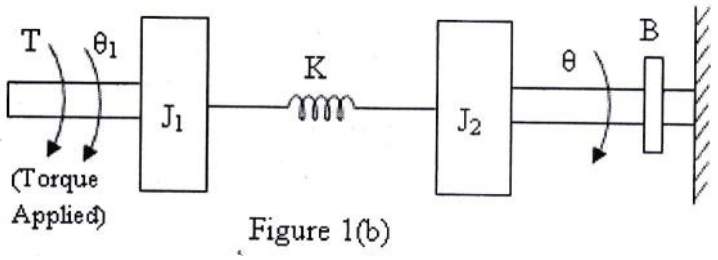

Figure 1(b)

P.T.O

(OR)

2. a) Derive the Transfer Function of DC Servo motor.

   b) Find the transfer functions $C(s)/R_1(s)$ and $C(s)/R_2(s)$ for the signal flow graph show in Figure (2b).

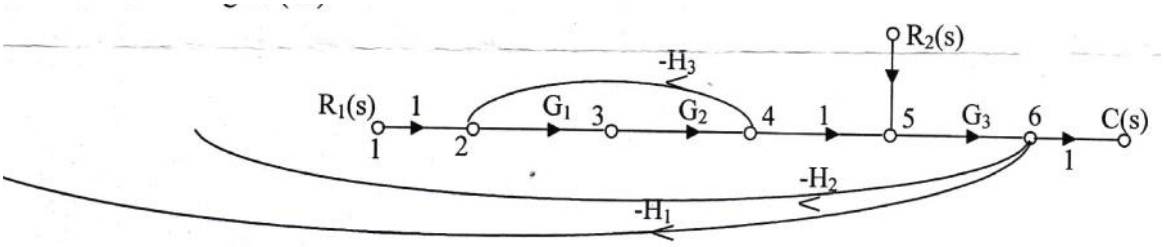

Figure (2b)

UNIT-II

3. Determine the damping ratio, undamped natural frequency, damped natural frequency for the system shown in Figure 3. What is the response c(t) of this system to a unit step function excitation r(t)=u(t) when all initial conditions are zero? Also, find out the t_r,t_p, t_s.

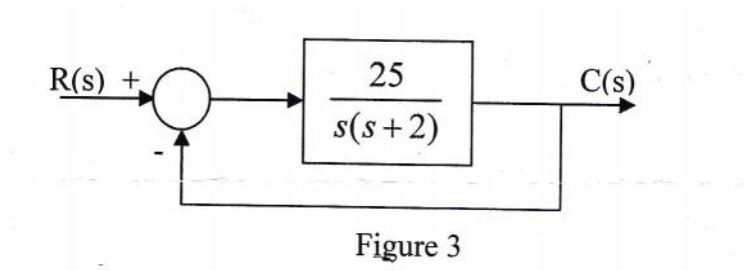

Figure 3

(OR)

4. a) State and explain Routh Hurwitz stability criterion.

   b) Define the steady state error and error constants of different types of inputs.

UNIT-III

5. Sketch bode plot for a system $G(s)=\frac{256(1+0.5s)}{s(1+2s)(s^2+3.2s+64)}$. Hence determine the stability of the system.

P.T.O

(OR)

6. a) Explain the effect of addition of a pole at the origin on the polar plot of a given system.

   b) A system is given by $G(s)=\frac{4s+1}{s^2(s+1)(2s+1)}$. Sketch the Nyquist plot & hence determine the stability of the system.

UNIT-IV

7. a) What is a lag compensator, obtain the transfer function of lag compensator and draw pole-zero plot?

   b) A unity feedback control system has an open loop transfer function $G(s)=\frac{K}{s(s^2+4s+13)}$. Sketch the root locus.

(OR)

8. a) Discuss the significance of state space analysis.

   b) Find the homogeneous solution for the system, $\dot{X}=\begin{bmatrix}0 & 3\\ -2 & -5\end{bmatrix}X$ with the initial - sate vector $X(0)=\begin{bmatrix}1\\0\end{bmatrix}$

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III/IV B.Tech. DEGREE EXAMINATIONS, APRIL/MAY- 2017

First Semester

EC/EE/EI/IE

LINEAR CONTROL SYSTEMS

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

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

Answer One Question from each Unit. **4X14=56 M**

1. a) What is impulse signal? How will represent it?
   b) What is basic components of signal flow graph?
   c) What is the importance of test signals?
   d) What is synchro?
   e) Define corner frequencies?
   f) Define sensitivity?
   g) Write manson's gain formula?
   h) Define relative stability?
   i) What is zero input stability?
   j) What are dominant poles?
   k) Write the significance of root locus?
   l) What is damping factor?
   m) Define angle of arrival?
   n) Define observability?

UNIT-I

2. a) Obtain the C(s)/R(s) for the flow grph shown in Figure 1 using mason's gain formula.

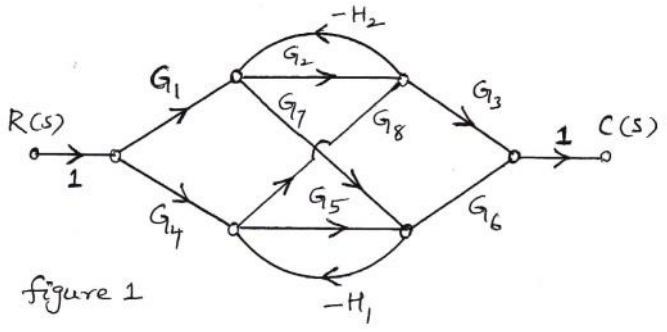

figure 1

   b) Explain the working of AC servo motor with necessary diagrams?

P.T.O

(OR)

3. a) Write the differential equations for mechanical system shown in figure 2 and obtain its transfer function?

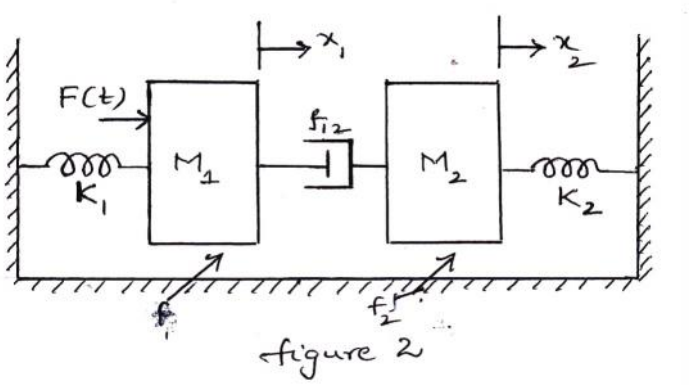

figure 2

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

UNIT-II

4. a) A unity feedback 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 feedback 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.

P.T.O

UNIT-III

6. a) Explain the correlation between time and frequency response analysis?

   b) Draw the bode plot for the system having open loop transfer function

   $G(s) = \dfrac{100}{S + (1 + 0.5S) + (1 + 0.1S)}$ with unity feedback? Find all cross over fre quencies and margins? Also comment on closed loop stability.

(OR)

7. a) Sketch the Nyquist plot for system with $G(S)H(S) = \dfrac{(1 + 0.5S)}{S^2(1 + 0.1S)(1 + 0.02S)}$

   comment on the stability.

   b) Explain assessment of relative stability using Nyquist criterion?

UNIT-IV

8. Sketch the complete root locus for the system having

   $G(S)H(S) = \dfrac{K}{S(S + 3)(S^2 + 3S + 4.5)}$. Determine the range of K for which the system is stable.

(OR)

9. a) Explain advantages of state varible method over conventional one?

   b) A system with state model matrix.

   $A = \begin{bmatrix} -1 & 0 & 1 \\ 1 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}^T$ obtain the system transfer function? Also determine whether the system is controllable?