Code No: 125DU **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May - 2018
CONTROL SYSTEMES ENGINEERING
(Common to ECE, ETM)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A
(25 Marks)

1.a)	What are the feed-back characteristics?	[2]
b)	State and write the Mason's gain formula.	[3]
c)	What are the time domain specifications?	[2]
d)	What are the demerits of static error coefficient method?	[3]
e)	What is the concept of stability?	[2]
f)	States the Routh's stability criterion?	[3]
g)	States the Nyquist stability criterion.	[2]
h)	What is meant by Compensation in control systems?	[3]
i)	States the properties of STM.	[2]
j)	What are the merits of state variable technique?	[3]

PART - B
(50 Marks)

2.a) What do you mean by a block diagram? What is meant by summing point and takeoff point? List the merits of block diagram representation.
b) Determine the transfer function of the system given in below figure 1. [5+5]

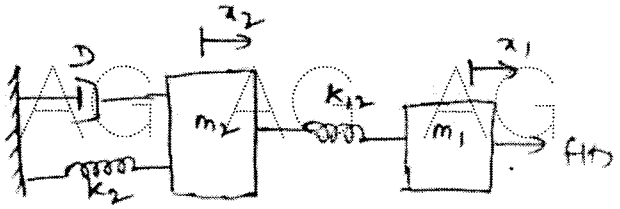

Figure 1

OR

3.a) Compare the open loop and closed loop control systems
b) Using block diagram reduction technique find the transfer function for the system shown in below figure 2. [5+5]

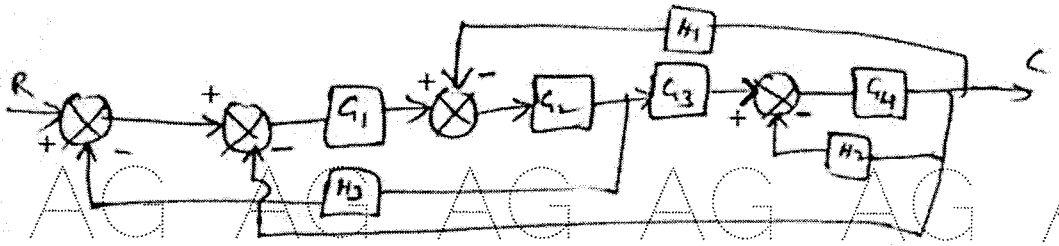

Figure 2

4.a) Derive the expression for response of second order system with unit step input.

b) For a negative feedback control system $G(s) = \frac{8}{s(0.2s+1)}$ and $H(s) = \frac{3}{s+2}$. Using generalized error series determine the steady state error of the system when the input applied is $r(t) = 1+2t+5t^2$. [5+5]

OR

5.a) What is meant by step input, ramp input and impulse input? How do you represent them graphically?

b) A unity feedback control system has an open loop transfer function $G(s) = \frac{7}{s(s+2)}$. Determine the time domain specifications for a step input of 10 units. [5+5]

6.a) Describe the effects of adding poles and zeros to G(s) H(s) on the root loci with necessary diagrams.

b) Determine the stability of a closed loop control system whose characteristic equation is

$$s^5 + 3s^4 + 2s^3 + 6s^2 + 6s + 9 = 0$$ [5+5]

OR

7. For a unity feedback system, the open loop transfer function is

$$G(s) = \frac{k}{s(s+1)(s^2+4s+13)}$$

Sketch the root locus and find the value of k to maintain the stability. [10]

8. Sketch the bode plot and determine the following:
a) Gain cross over frequency,
b) Phase cross over frequency,
c) Gain margin
d) Phase margin.

For the transfer function is given $G(s) = \frac{8}{s(s+3)(s+5)}$. [10]

OR

9. A unit feedback system has an open loop transfer function $G(s) = \frac{k}{s(s+4)(s+2)}$. Design a phase lag compensator to meet the specifications, velocity error constant = 7 and phase margin $\geq 35^0$. [10]

10.a) Write the general procedure to determine the state space models of a control system.

b) A system is described by

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

Check the controllable and observability of the system. [5+5]

OR

11. The state variable formulation of a system is given by

$[\dot{x}] = \begin{bmatrix} -2 & 1 \\ -1 & 0 \end{bmatrix} [x] + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ and $y = \begin{bmatrix} 1 & 0 \end{bmatrix} [x]$. Determine the following

a) Transfer function of the system
b) State transaction matrix and
c) State equation for a unit step input under zero initial condition. [10]

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