Code No: 115DU **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2016
CONTROL SYSTEMS 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) Give the Mason's Gain formula. [2]
b) List out the classification of control systems. [3]
c) What is meant by un-damped response? [2]
d) Write the effects of proportional derivative systems on second order response. [3]
e) What is the need of angle of asymptotes in Root-locus? [2]
f) Write the remedies if an entire row is zero while computing elements in R-H array. [3]
g) Draw the pole-zero plot of Lag compensator. [2]
h) Define gain-cross over frequency and phase-cross over frequency. [3]
i) Draw the state diagram of a state model. [2]
j) What is meant by diagonalization? Explain. [3]

PART - B

(50 Marks)

2.a) Discuss the characteristics of feedback in closed loop control system.
b) Define the Impulse response of the system. Also find the impulse response of the system with open loop transfer function. [5+5]

$$G(s) = \frac{10}{s(s+3)}$$

OR

3. Obtain the transfer function $\frac{Y(s)}{R(s)}$ for the flowing block diagram (figure 1): [10]

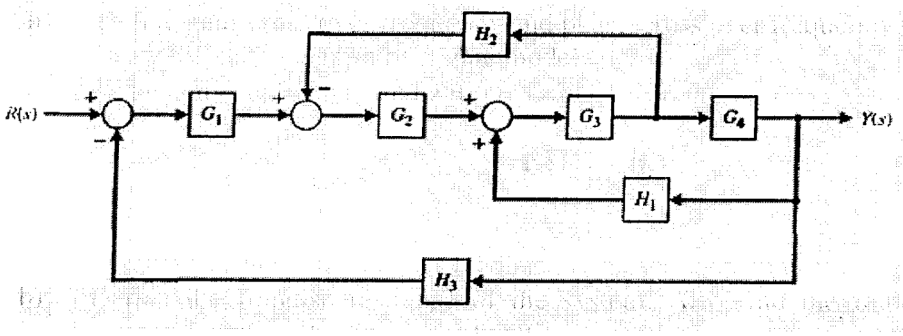

Figure 1

4.a) Sketch the time response of the following figure 2 first order system when excited with unit step input.

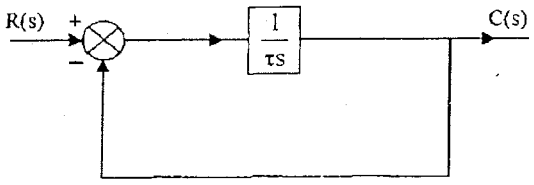

Figure 2

b) A second order system has a transfer function $(s) = \frac{25}{(s^2+8s+25)}$, Determine the settling time and peak overshoot when the system is excited with unit step input. [5+5]

OR

5.a) Find the steady state errors for the unit step, unit ramp and unit parabolic inputs for the system whose transfer function is $G(s) = \frac{1000(s+1)}{(s+10)(s+50)}$

b) Discuss the significance of 'type' and 'order' of the system in time response analysis. [6+4]

6. Define Root locus and explain procedure to sketch the Root-locus for a given transfer function. [10]

OR

7.a) Comment on system stability if the characteristic equation of closed loop system is

$$Q(s) = s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$$

b) A unity feedback system with open loop transfer function $G(s) = \frac{K}{s(s+1)}$. Determine the range of 'K' for which system to be stable. [5+5]

8. Sketch the Bode plot for the unity feedback system with open loop transfer function

$$G(s) = \frac{80}{s(s+2)(s+20)}$$

Also find its gain margin and phase margin. [10]

OR

9.a) State and explain Nyquist stability criterion.

b) What is PID controller and write its merits and demerits. [5+5]

10.a) What is state transition matrix and derive its expression.

b) Obtain the state model for the system which is described as

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 10y(t) = 5u(t)$$

Here, 'y' is output variable and 'u' is input variable. [4+6]

OR

11.a) Explain the concept of controllability and observability.

b) Write the advantages of state space analysis over transfer function approach. [5+5]

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