

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]

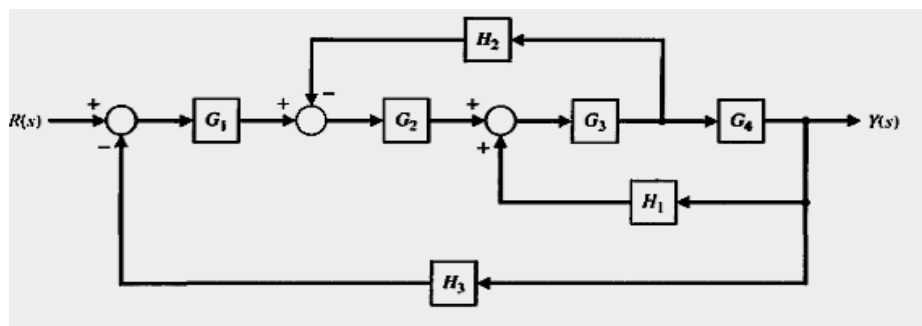


Figure 1

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

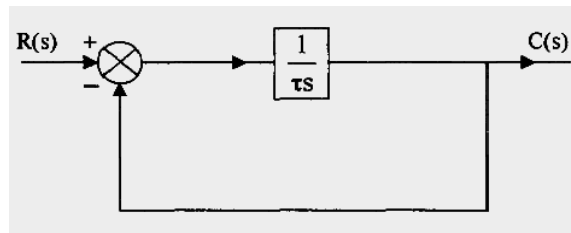


Figure 2

- 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]

---ooOoo---