Roll No. ..... Total Pages : 03

BT-5/D-18 35112

CONTROL SYSTEM ENGG.

ECE-307N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

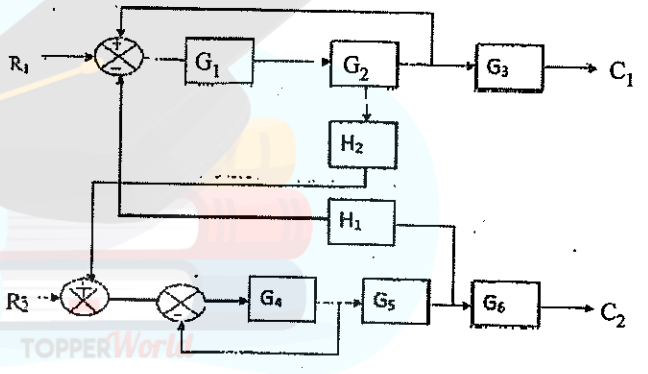
Unit I

1. (a) Explain open loop and close loop control system with examples. **5**

   (b) Explain for Mason's gain formula and its applications. **5**

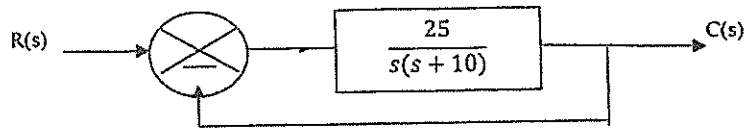
   (c) Describe the differential equation of physical system. **5**

2. (a) Find C/R for the control system shown in fig. below :



TOPPERWorld

(b) Derive the Transfer function of close loop system shown in fig. below : **5**



Unit II

3. (a) Discuss the unit step response of second order system. **5**

(b) Construct Routh array and determine the stability of the system whose characteristics equation is $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ Comment on the location of the roots of characteristic equations.

4. (a) Sketch the root locus of the system having

$$G(s)H(s) = \frac{k(s+2)}{(s+1)(s+3+j2)(s+3+j2)}$$ for

positive value of K. **10**

(b) Explain step response of II order system in detail.

Unit III

5. (a) Explain the frequency domain specifications of a typical system. **5**

TOPPERWorld

(b) Sketch Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec. **10**

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$$

6. Using Nyquist criterion, investigate the stability of a closed loop control system whose open loop transfer function is given below : **15**

$$G(s)H(s) = \frac{K}{S(ST_1+1)(ST_2+1)}$$

Unit IV

7. (a) Discuss the merits and demerits of representing a state model into : **10**
   (i) Physical variable form
   (ii) Phase variable form
   (iii) Canonical variable form

   (b) Draw the steps involved in the design of Lag compensator $G(s) = \frac{\omega_n^2}{s(s^2+2\varepsilon\omega_n)}$. **5**

8. Write short notes on any *three* of the following : 5×3=15
   (i) Concept of state variables
   (ii) Phase lead compensation
   (iii) Feedback Compensation
   (iv) State Space Analysis.