Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech 2nd year

Branch : ECE

Semester: 4th

Title of the Course : Control Theory

Course Code: ECL-251

Time: 3 Hours

Maximum Marks: 50

Section-1

Note: Attempt all questions **[5×2=10]**

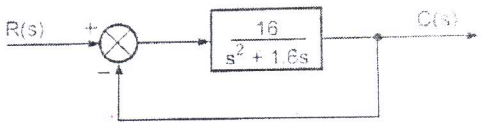
Q.1 Determine the overall transfer function.

Q.2 Find the valid breakaway point of the given system.

$$G(s)H(s) = \frac{K}{S(S+2)(S+3)}$$

Q.3 Consider a unity feedback control system with a closed loop transfer function $\frac{C(s)}{R(s)} = \frac{Ks+b}{s^2+as+b}$. Determine the open loop transfer function G(s), and find the steady state error with unit ramp input.

Q.4 A unity feedback control system is shown in figure below. By using derivative control the damping ratio is made to be 0.8. Determine the value of constant T_d.

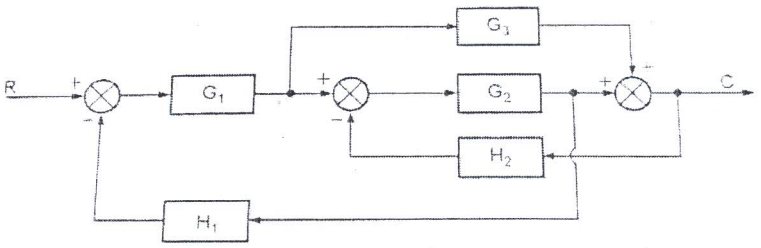


Q.5 Find the sensitivity of closed loop transfer function.

Section-2

Note: Attempt any four questions [4×5=20]

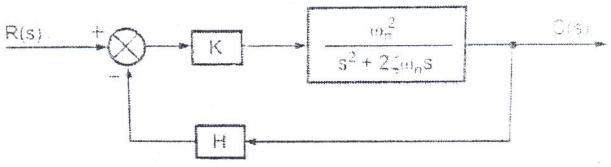
Q.1 Find the C/R using signal flow diagram method.



Q.2 Determine the position, velocity and acceleration error coefficients for the given system.

$$G(s) = \frac{K}{S(S^2+2\zeta\omega_n+\omega_n^2)} \quad \text{(unity feedback)}$$

Q.3 Determine the sensitivity of the overall transfer function for the system with respect to change in parameter K.



Q. 4 Using R-H criterion determine the relation between the K and T so that unity feedback control system whose open loop transfer function given below is stable.

$$G(s) = \frac{K}{S(S(S+10)+T]}$$

Q.5 The transfer function of a control system is given by

$$\frac{Y(s)}{U(s)} = \frac{s+2}{s^3+9s^2+26s+24}$$

Check for controllability.

Section-3

Note: Attempt any two questions [2×10=20]

Q.1 Using Nyquist criterion investigate the closed loop stability of the system whose open loop transfer function is given below.

$$G(s)H(s) = \frac{K(s+1)}{(s+0.5)(s-2)}$$

Consider (i) K=1.25 (ii) K=2.5

Q.2 Sketch the root locus for the open loop transfer function of unity feedback control system given below.

$$G(s) = \frac{K}{s(s+1)(s+3)}$$

Q.3 Derive the transfer function of the system from the given data on the Bode plot diagram.