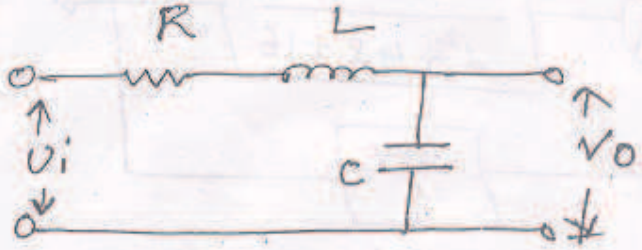
(2) Make suitable assumption wherever **required**.
(3) Attempt total **five** questions.
(4) **Figures** to the **right** indicate marks.

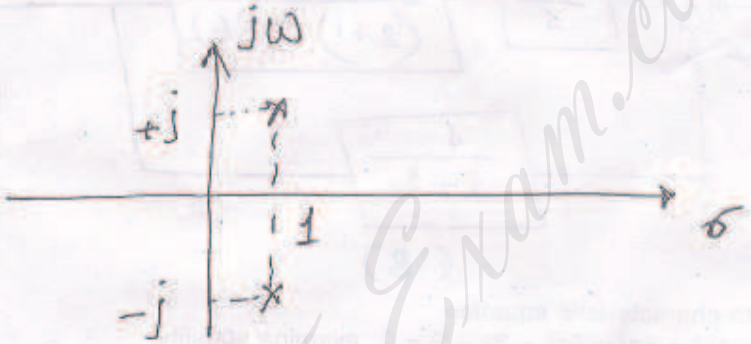
1. (a) Find the transfer function $\frac{C(s)}{R(s)}$ of a system having diffrential equation given below : 5

$$2\frac{d^2c(t)}{dt^2} + 2\frac{dc(t)}{dt} + c(t) = r(t) + 2r(t-1)$$

(b) Find out the transfer function for the following network using signal flow graph. 5



(c) Estimate the step response of the system having following possible pole locations. 5

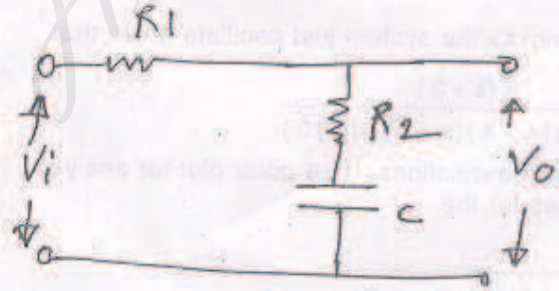


(d) Show possible nature of polar plots for the systems having following transfer function. 5

(i) $G_A(s) = \frac{k}{s^2(1+sT_1)}$

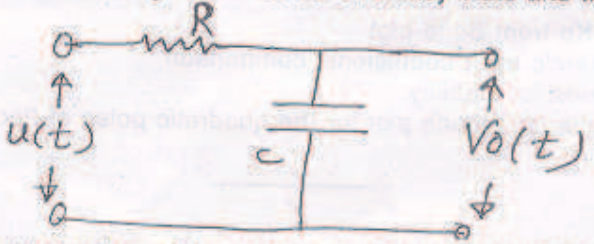
(ii) $G_B(s) = \frac{s}{1+sT_1}$

2. (a) Draw the signal flow graph for the following network and find the transfer function. 10



(b) Compare block diagram reduction and signal flow graph reduction techniques explicitly. 10

3. (a) Find out the total response of the system in terms of steady state and transient response. 10



Comment on the transient behaviour of the system if the input is scaled by A units i.e. A.U(t). Draw graphs for total responses.

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(b) For the unity feedback system having opne loop transfer function

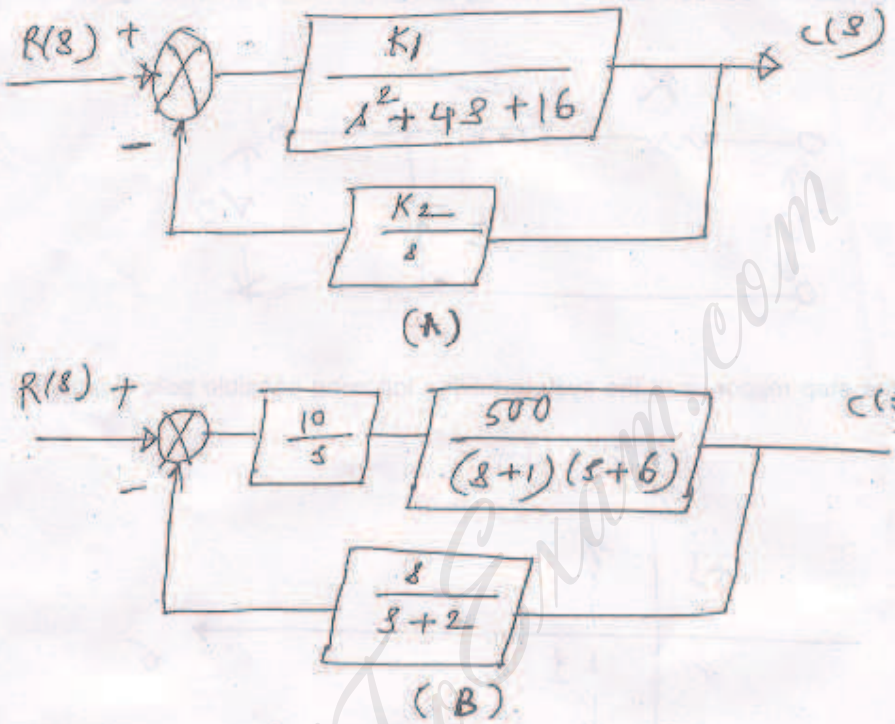
$$G(s) = \frac{k(s+2)}{s\left(s^3+7s^2+12s\right)}$$

Find :

(i) Type of the system 2
(ii) Static error coefficients 4

(iii) Steady state error when input to the system is $\frac{R}{2}t^2$ 4

4. (a) Determine order and type of the system which are represented by block diagrams in **figure**. 10



(b) For a system with characteristic equation 10
$F(s) = s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$ examine stability.

5. (a) For a unity feed back system 10

$$G(s) = \frac{800(s+2)}{s^2(s+10)(s+40)}$$

Sketch the bode plot, asymptotic in nature comment on stability.

(b) Define the following terms : 10

(i) Corner frequency
(ii) Bandwidth
(iii) Phase Margin
(iv) Gain Margin
(v) Break away and entry points

6. (a) Find the value of K which makes the system just oscillate given that 10

$$G(s) = \frac{K(s+2)}{s(s+2)(s+4)(s+8)(s+10)}$$

and also find the frequency of oscillations. Use polar plot for analysis.

(b) Draw the complete root locus for the 10

$$GH(s) = \frac{K}{s(s+4)(s^2+2s+2)}$$

Determine value of K for stability. Determine also oscillating frequency.

7. Write short note on :

(a) Calculation of Kp from Bode plot 5
(b) Static and Dynamic error coefficients comparison 5
(c) Hurwitz's criterion for stability 5
(d) Effect of ξ on the magnitude plot for the quadratic poles of 2nd order system. 5