

- g) A unity feedback system has an open loop transfer function  $G(s) = \frac{K}{s(s+a)^2}$ . Determine the values of K and 'a' for which the gain margin is 9.54dB and the phase crossover frequency is 3 rad/sec.
- h) State the condition of BIBO stability and derive its expression?
- i)  $\ddot{x} - (K+2)\dot{x} + (2K+5)x = 0$ . Find the value of K for which system is stable, unstable and Limited stable. For stable case for what a value of K is the system is under damped and over damped.
- j) Derive the generalised error coefficient?
- k) Using Nyquist criterion determine the stability of the system  $G(s)H(s) = \frac{10(s+3)}{s(s-1)}$ .
- l) An integral controller is used for temperature control within a range 40-60°C. The set point is 48°C. The controller output is initially 12% when the error is zero. The integral constant  $K_i = -0.2\%$  controller output/sec/% error. If the temperature increases 54°C. Calculate the controller output after 2sec for a constant error.

### Part-III

#### Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3 Sketch the nquist plot for the system with open loop transfer function (16)

$$G(s)H(s) = \frac{K(1+0.5s)(s+1)}{(1+10s)(s-1)}$$

Determine the range of K for system is stable.

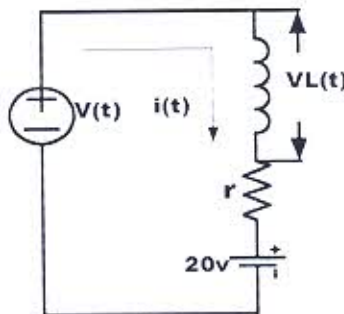
- Q4 Sketch the Root Locus of the system whose transfer function is given (16)

$$G(s)H(s) = \frac{K}{s(s+2)(s-4)}$$

- What is the value of K which will produce sustained oscillation and Find the range of K for which the system is stable?
- What is the value of K for which the system is critically damped?
- For  $K=8$ , find  $\xi, \omega_n, t_s, e_{ss}$  and peak overshoot and closed loop transfer function.
- Find the range of K for which the system response is under damped or system shows damped oscillatory response.

- Q5 Find the transfer function  $\frac{V_L(s)}{V(s)}$  for the electrical network which contain nonlinear (16)

resistor whose voltage current relationship is defined by  $i_r = 2e^{0.1V_r}$ , where  $i_r$  and  $V_r$  are the resistor current and voltage respectively. Also  $V(t)$  is a small signal source.



- Q6 For a first order time delay process how can you determine the PID controller parameters using Zeigler-Nichols method? Explain with examples. (16)