## ASSIGNMENT 4

# ROOT LOCUS ANALYSIS

(1) Explain the various rules for construction of root locus.

(2) Draw the approximate root-locus diagram for close loop system whose transfer function is given by

$$G(s)H(s) = \frac{K}{S(S+5)(S+10)}$$

(3) The open loop transfer function of a feedback control system is given by

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

Draw complete root locus plot as *K* varies from 0 to ∞. Also calculate the value of *K* for which the system becomes oscillatory.



(4) Obtain root-locus plot for the unity feedback system with transfer function.

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

(5) Sketch the root loci of unity feedback control system on a graph paper using a suitable scale, whose open-loop transfer function is given below. Determine the range of gain for stability and the point at which it crosses the imaginary axis. Determine the value of gain K at the breakaway point.

$$\frac{K}{S(S+4)(S^2+4S+8)}$$

(6) Explain how (i) Breakaway points (ii) the point at which root locus crosses imaginary axis

and (iii) response of closed loop system at a given value of gain are found for a root locus of given system. Explain how at a given point on the root locus, the gain can be determined.

(7) (i) State whether the root locus tool is a frequency response or a time response tool.
(ii) Compare root locus technique and Bode plots for control system analysis purpose. Explain how root locus technique is more difficult than the Bode plots.
(iii) Explain the frequency response, state its applications with possible limitations