

- Q1. Sketch the Nyquist plots for a system whose open loop transfer functions is  $\frac{K(s+7)}{s^2(s+2)(s+11)}$  choosing the appropriate Nyquist contour. Determine the range of K for which the closed loop system is stable. Verify the same using MATLAB instructions. Also calculate Gain Margin expression in terms of K.
- Q2. In a unity negative feedback control system, the transfer function of plant is  $\frac{50}{s^2 - 20}$ . Design a Proportional (gain K) and Derivative output (gain  $K_t$ ) controller to meet the following specifications:  
*Settling Time (for 5% tolerance band)  $\leq 75$  ms; Peak Overshoot  $\leq 16\%$*
- Q3. Sketch root locus for a negative feedback systems whose open loop transfer functions is  $\frac{K}{s(s^2 + 2s + 7)}$  and therefrom determine the range of K for which the closed loop system is stable. Also verify the same using MATLAB instructions.
- Q4. The open loop transfer function of a unity negative feedback system is  $\frac{K(s+1)}{(5s+1)(s^2 + 2s + 4)}$ . Draw the Bode's plots so that steady state error is 16%. From the plots determine the gain margin & phase margin and comment on system stability. Also verify the same using MATLAB instructions.
- Q5. Reduce the given block diagram using MATLAB instructions and get the transfer function  $C(s)/R(s)$ .

