ASSIGNMENT-2

1. Sketch the **Bode plots** and **Nyquist diagrams** for the systems with the transfer functions given below:

   (a) $$G(s) = \frac{10}{s(s+5)}$$

   (b) $$G(s) = \frac{s+1}{s(s+5)}$$

   (c) $$G(s) = \frac{50}{(s+2)^2}$$

   (d) $$G(s) = \frac{10e^{-s}}{(s+1)(s+3)}$$

   (e) $$G(s) = \frac{1}{s^2+3s+1}$$

2. Using the **Bode stability criterion**, determine whether the control systems with the following open-loop transfer functions are stable or unstable as given below:

   (a) $$G_{OL} = \frac{1}{s-1}$$

   (b) $$G_{OL} = \frac{10e^{-3s}}{4s+1}$$

   (c) $$G_{OL} = \frac{5e^{-5s}}{(2s+1)(s+1)}$$

   (d) $$G_{OL} = \frac{1}{0.2s^2+0.8s-1}$$

3. Compute the **phase and gain margins** for the feedback systems with the open-loop transfer functions given in Problem 2. Determine whether the systems are stable or unstable based on these values.
4. Employing the **Nyquist criterion** to examine the stability of the closed-loop systems whose open loop transfer functions are given in Problem 2.
5. Compute the **Ziegler-Nichols** settings for the PID controller considering a process with transfer function given below:

$$G_p = \frac{10e^{-0.1s}}{2s+1}$$