



Arab Academy for Science and Technology & Maritime Transport  
College of Engineering & Technology

Department : Electrical power and computer control

Course : Control System I

Course No: EE 411

Lecturer : Prof. Dr. Hassan Ibrahim

TA : Eng.

### Sheet (3)

1. A control system with unity feedback has the following forward T.F

$$G(s) = \frac{k}{s(0.1s + 1)\left(\frac{1}{625}s^2 + \frac{30}{625}s + 1\right)}$$

- Draw the bode diagram for  $k = 1$ .
- Draw the bode diagram for  $k = 10$ . Is the system stable in the two cases.

2. Draw the bode diagram representation for a unity feedback system

a)  $G(s) = \frac{1}{(0.5s + 1)(2s + 1)}$

b)  $G(s) = \frac{0.5s + 1}{s}$

c)  $G(s) = \frac{30(s + 8)}{s(s + 2)(s + 4)}$

d)  $G(s) = \frac{1000}{s(s + 5)(s^2 + 10s + 100)}$

e)  $G(s) = \frac{2(0.3s + 1)}{s^2(0.1s + 1)(0.5s + 1)}$

3. A system has  $G(s) = \frac{2(\tau_2 s + 1)(\tau_3 s + 1)}{s^2(\tau_1 s + 1)(\tau_4 s + 1)}$

Where  $\tau_1 = 4$  ,  $\tau_2 = 1$  ,  $\tau_3 = 0.5$  ,  $\tau_4 = 0.25$  sec

Draw the bode diagram and determine the corner Frequency.

4. For a unity feedback system has a forward T.F  $G(s) = \frac{4k}{s(s + 2)}$

It is required to compensate the system so that the static velocity  $k_v = 20 \text{sec}^{-1}$

And the phase margin  $\phi_m = 50^\circ$ .

5. For a unity feedback system has a forward T.F  $G(s) = \frac{k}{s(s+1)(0.5+1)}$

It is required to compensate the system so that the static velocity  $k_v = 5 \text{ sec}^{-1}$  and

The phase margin  $\phi_m = 40$ .

6. Design a compensator for a type one system with an open loop T.F  $G(s) = \frac{k}{s^2(0.2s+1)}$

Such that :

- a) Velocity error constant  $k_v = 10$
- b) Phase margin = 35

7. For a unity feedback system with an open loop T.F  $G(s) = \frac{k}{s(10s+1)}$  , design a compensator

Such that :

- a) Steady state error to a step input to be less than 5%.
- b) M.O.S.% is less than 15%.

8. A system has the following open loop T.F.  $G(s) = \frac{k}{s(s+1)^2}$  Design a compensator

Such that :

- a) Damping factor = 0.5
- b) Velocity error of no more than 10%