1) Block diagram of a positional servo system with velocity feedback is shown in Figure-1. Find the following values of the position control system according to the given unit step response in Figure-2.

- damping ratio $\zeta$,
- damping angle $\beta$,
- undamped natural frequency $\omega_n$,
- damped natural frequency $\omega_d$,
- decay rate $\sigma$,
- settling time $t_s$, (0.02 criterion)
- peak time $t_p$,
- $K$ and $K_v$
2) Using first order factors, determine the transfer function $G(s)$ corresponding to the following magnitude diagram which is drawn by straight line approximation.
3) For the systems given below

\[ G(s) = \frac{s+40}{2(s+1)^2} \]

\[ G(s) = \frac{100s}{(s+1)(s+5)} \]

\[ G(s) = \frac{5s+250}{(s^2+4s+25)} \]

a) Determine the amplitude ratio and phase angle expressions as a function of excitation frequency \( \omega \).

b) Obtain the steady state solution of the response of the system to the given input below as a function of time.

\[ x(t) = (5 \cos 3t + 7 \sin 2t + 1)h(t) \]

c) Draw the Bode diagram of the system (both magnitude and phase), by hand, using the straight line approximation.