Plots and figures for part 1.a :

Design a Compensator for a unity feedback system with open loop transfer function G(s)= K/(s(s+1)(0.5s +1)) to satisfy the following specifications: (i) velocity error constant K_v=5, (ii) Phase margin =40 degrees. (iii)Gain Margin = 10dB

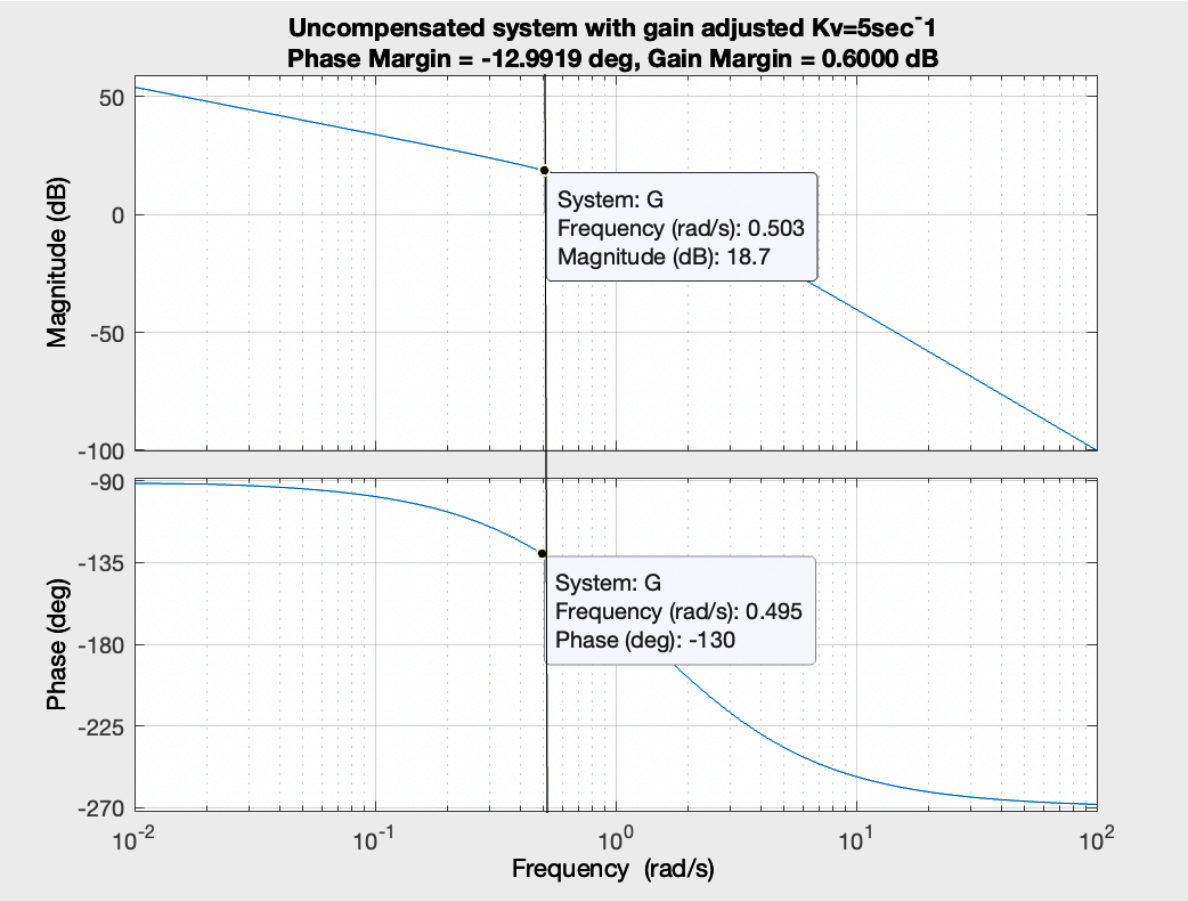

Fig 1.1: Bode plot for uncompensated gain adjusted system; 5/(s(s+1)(0.5s+1)). The freq at phi=-130 is 0.496 and the corresponding gain at that point is 18.9 dB(Values plotted in the graph are added manually so there its a slight discrepancy)

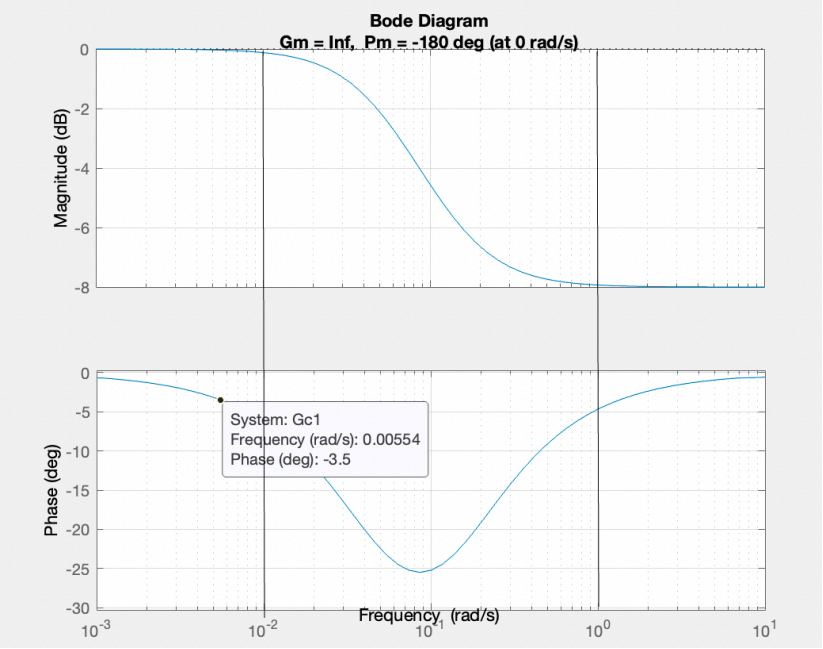

Fig 1.2: Bode plot for the lag compensator with:

Zero of the lead compensator is at s = 0.049176; Pole of the lead compensator is at s = 0.0055503

And the gain added is 18.9 dB at w = 0.496

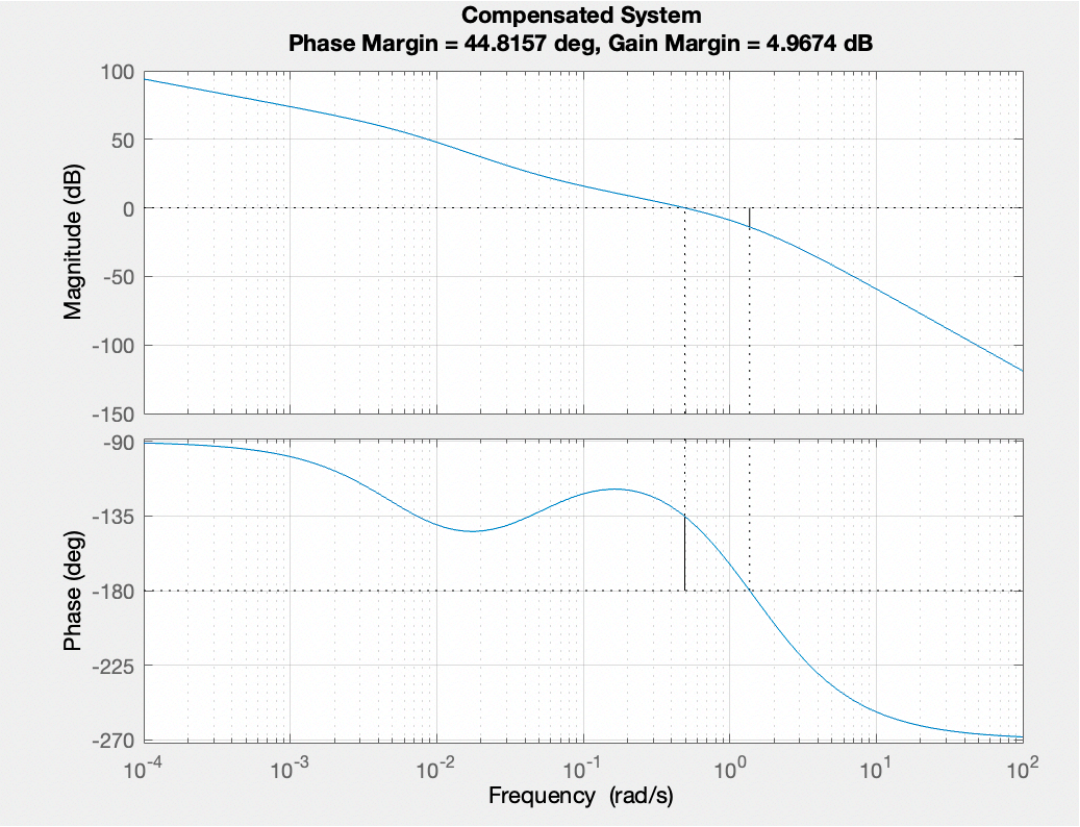

Fig 1.3: Bode plot for compensated gain adjusted system; (101.7 s + 5)/(90.09 s^4 + 270.8 s^3 + 181.7 s^2 + s). The system parameters obtains are :

- GM= 4.9674
- PM=44.8157
- wgc =1.3671

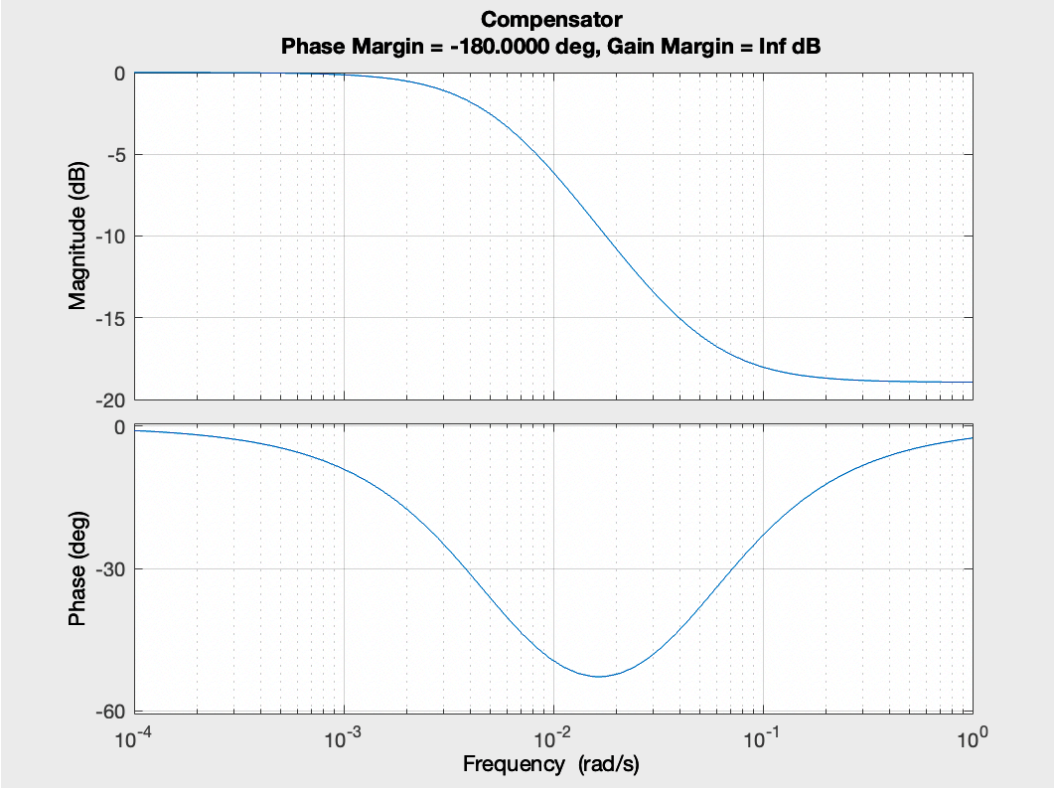

Fig 1.4: Bode plot for the secondary lag compensator with:

Zero of the lead compensator is at s = 0.1367; Pole of the lead compensator is at s = 0.054

And the gain added is 8 dB at w = 1.367

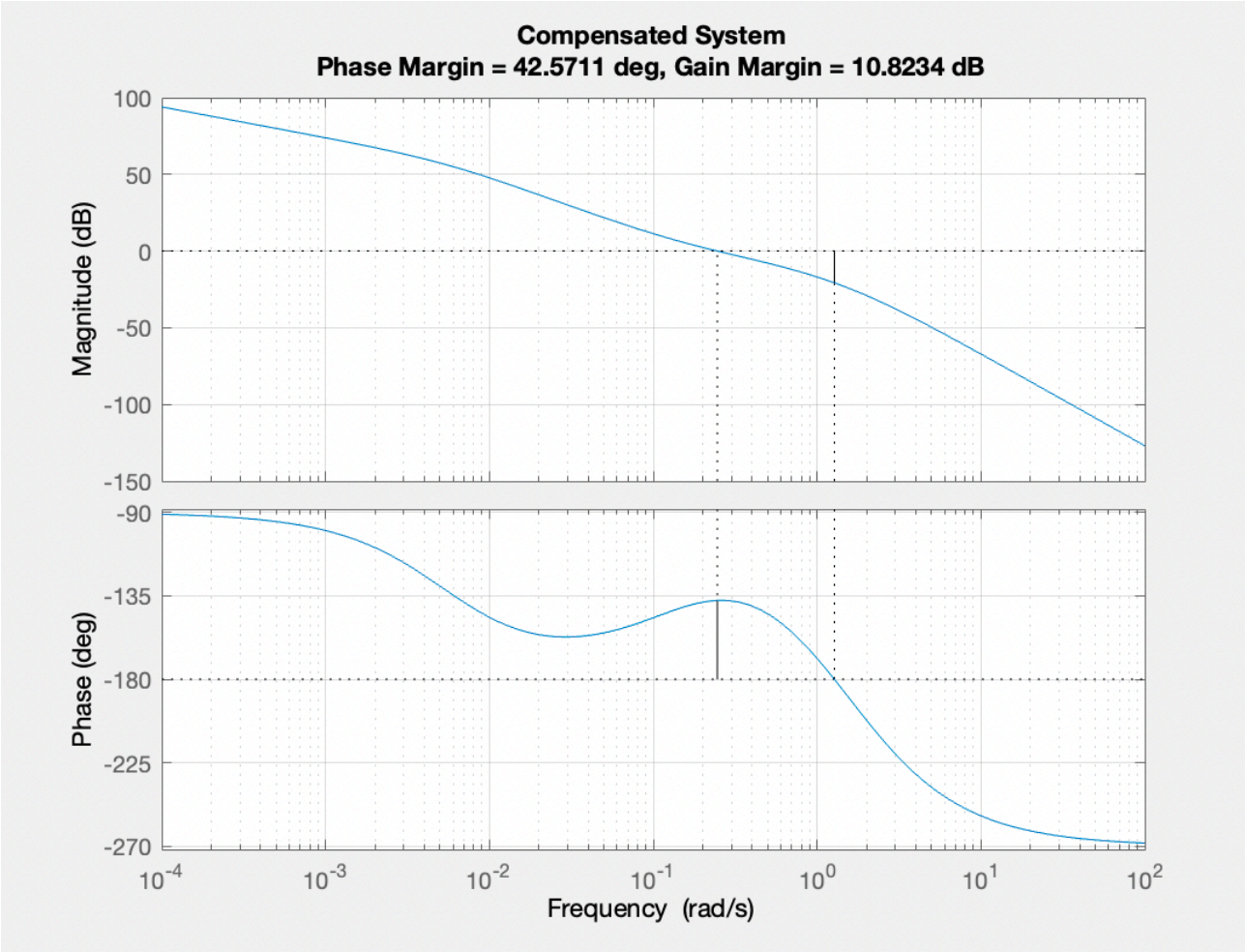

Fig 1.5: Bode plot for compensated gain adjusted system: (743.7 s^2 + 138.2 s + 5)/(1655 s^5 + 5065 s^4 + 3609 s^3 + 200 s^2 + s). The system parameters obtains are :

- GM = 10.8234
- Pm =42.5711

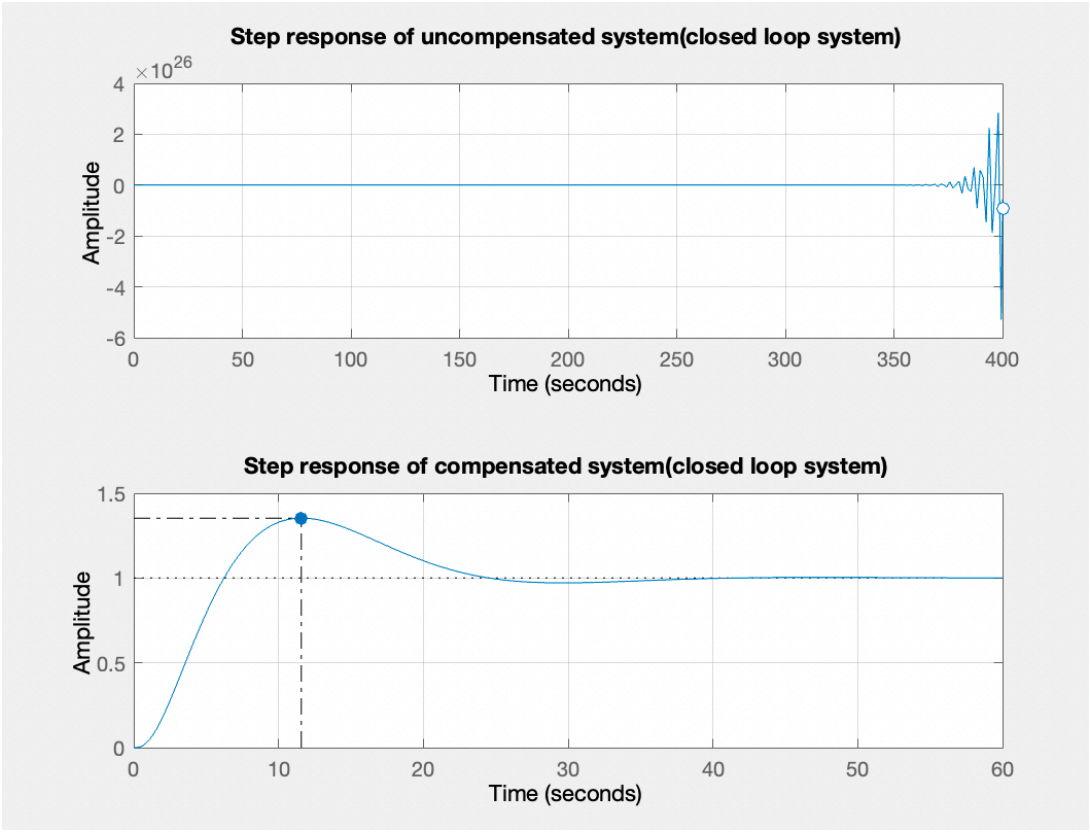

Fig 1.6: Step response of the compensated vs uncompensated system with

- T_rise = 7.8s
- T_settling = 35s
- T_peak = 11.9s
- M_p (%) = 33%

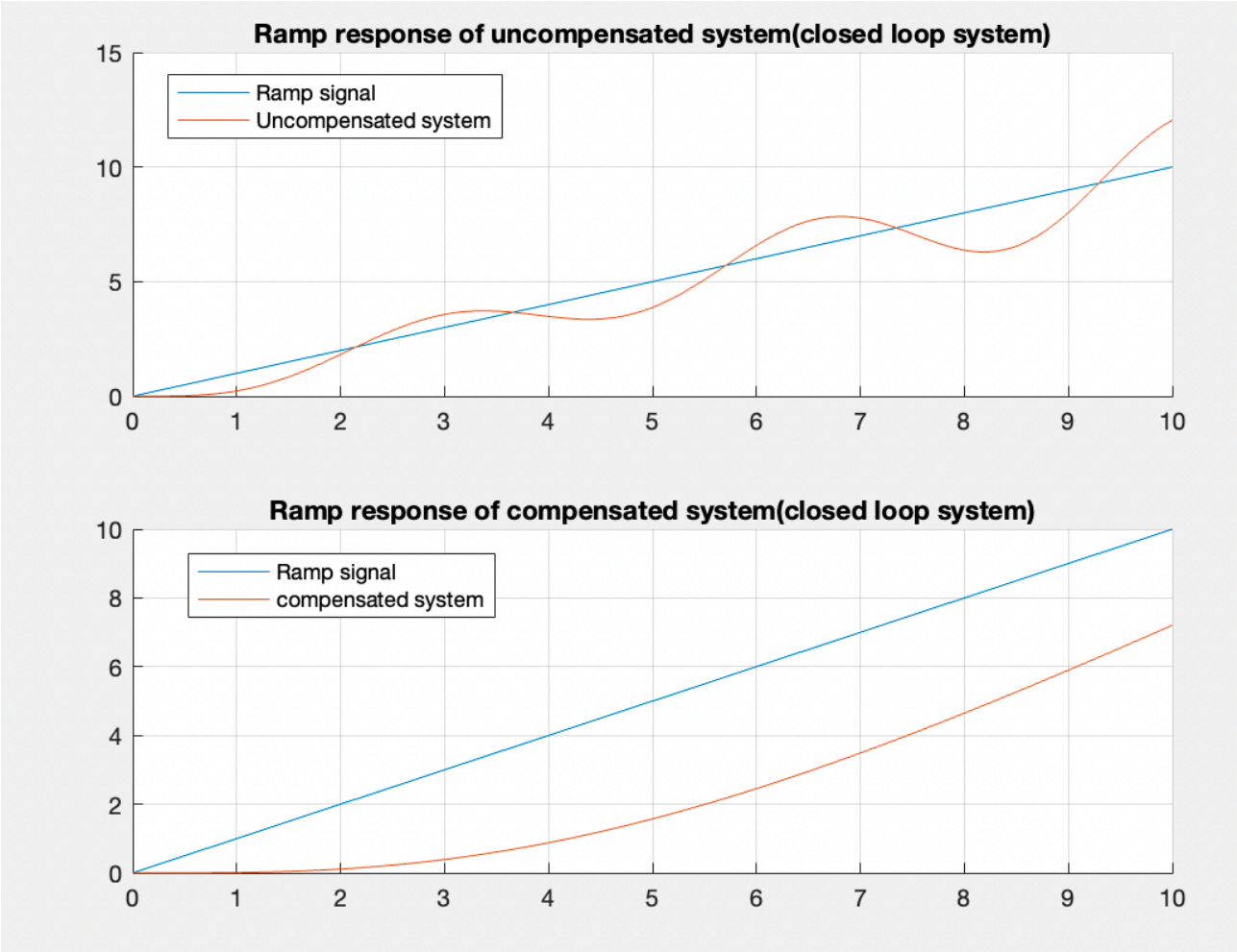

Fig 1.7: Ramp response of compensated vs uncompensated system for 0-10sec