Q1) for the block diagram shown in figure (1):

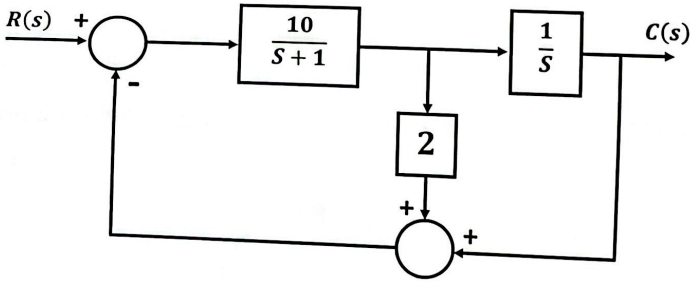

Figure (1)

a- Reduce the block diagram in order to find over all transfer function $\frac{C(s)}{R(s)}$?

b- Find damping ratio zeta (ζ) and natural frequency (ω_n) of $\frac{C(s)}{R(s)}$ in part (a)?

c- Determine whether the system response is undamped, overdamped, under damped or critically damped based on calculated damping ratio zeta (ζ) in part (b)?

Q2) Given a close loop system as shown in figure (2), find the values of K_1 and K_2 that yields a peak time equals to 1 second and settling time equals to 2 seconds, where $R(s) = \frac{1}{s}$?

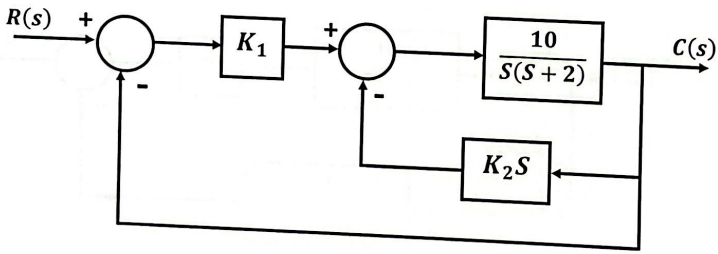

Figure (2)

Q3) Determine the stability using Routh criteria for the following system characteristic equations:

a- $S^4 + S^3 + 2S^2 + 2S + 5 = 0$

b- $S^4 - 1 = 0$

Q4) given a signal flow graph presented in figure (3), find $\frac{C(s)}{R(s)}$ using Mason's formula?

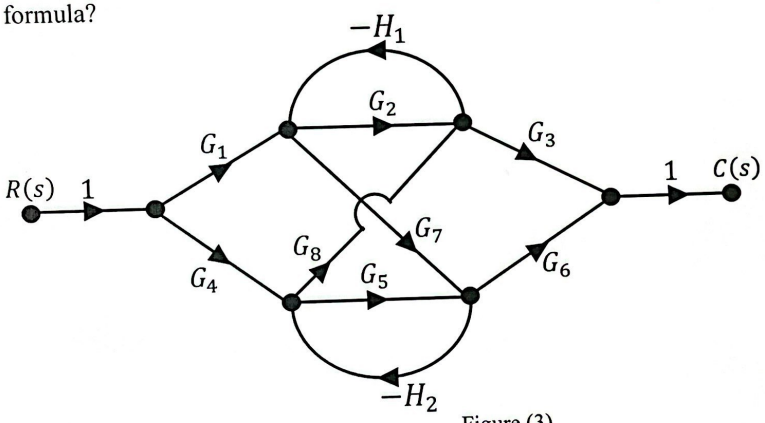

Figure (3)

Q5) Determine controller gain K to provide 2% steady-state error (e_{ss}) to a unit step input?

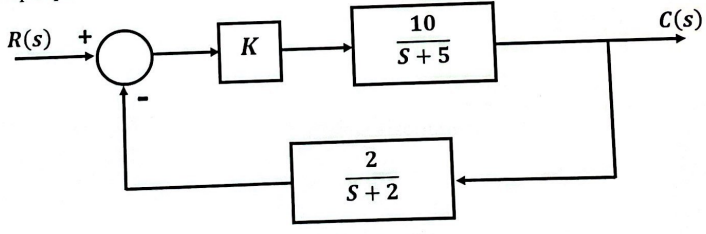

Figure (4)

تمنياتي للجميع بالتوفيق