Quiz-III, Control Systems (ME 325), Jan-April semester 2021

Time: 40 minutes, Marks: 35

Answer all questions

Q1. The open-loop transfer function of a unity-feedback control system is given by, $G(s) = A/(s+1)$.

A is a constant given by: $A = (0.1 \times q + 9.8)$, where ***the value of*** q ***is taken from the last three digits of your roll number*** (Example: if your Roll number is 180103221, then the value of q is 221).

Find: (i) closed-loop transfer function of the system; (ii) amplitude and phase angle of the sinusoidal transfer function of the closed-loop system; (iii) specify whether it is a phase-lag or phase-lead closed-loop system and (iv) steady-state output of the closed-loop system for the input $5\sin(2t)$.

[3]+[5]+[2]+[5]

Q2. The transfer function of a control system is given by,

$G(s) = A/(s+A)$, where the value of A remains the same as that is taken in **Q1**.

For the Bode diagram of the corresponding sinusoidal transfer function, find (i) the value of the corner frequency; (ii) draw asymptotes of the log-magnitude curve and (iii) actual log-magnitude (in dB scale) at the corner frequency.

[3]+[4]+[3]

Q3. For a second-order system, the transfer function is given by,

$G(s) = \dfrac{A}{s^2 + 0.4s + A}$, where the value of A remains the same as that is taken in **Q1**.

For the Bode diagram of the corresponding sinusoidal transfer function, find: (i) the value of the corner frequency; (ii) resonant frequency and (iii) maximum log-magnitude (in dB scale). [3]+[3]+[4]