Vivekanand Education Society's Institute of Technology

An Autonomous Institute Affiliated to University of Mumbai

End Semester Examination
Summer 2024

Max marks: 60 Duration: 2 hours
Branch: Automation and Robotics Semester: IV
Name of the Course: Automatic Control System
Course code: ARC403 QP Code: R23-ARC403_012023-24

N.B. (1) Attempt any three out of the five questions.
(2) Figures to the right indicate full marks.
(3) Assume suitable data if necessary

			Marks
Q.1	(a)	(i) List five distinctions between open loop and closed loop systems.	5
		(ii) Write the five differences between linear and nonlinear systems.	5
	(b)	Draw a neat diagram of a series RLC circuit with labels and derive the transfer function between output voltage across capacitor and the input voltage.	10
Q.2	(a)	Obtain the transfer function C(s)/R(s) for the following system.	10

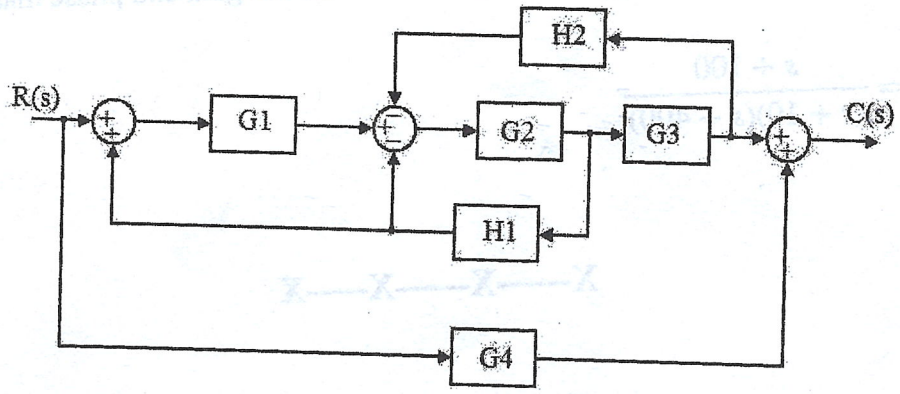

Fig. (1)

	(b)	What is the TYPE of the system? Write the expressions for the position, velocity and acceleration error constants; and steady-state errors corresponding to these constants.	10
Q.3	(a)	Compute (i) Damping factor (ii) natural undamped frequency (iii) rise time (iv) peak overshoot (v) settling time for the system with a transfer function, $G(s) = \frac{1}{s^2 + 1.2s + 1}$	10

(b) Find the output y(t) to the unit step input for the system that has transfer function 10

$$\frac{Y(s)}{R(s)} = \frac{1}{s^2 + 4.5s + 3.5}$$

Q.4 (a) Construct a root locus KG(s) for a system 10

$$G(s) = \frac{1}{s(s + 1.5)(s + 2)}$$

(b) Assess the stability using Routh's criterion for the system of characteristic equation, 10

$$s^5 + 2s^4 + 4s^3 + s^2 + 6s + 1 = 0$$

Q.5 (a) Construct the polar plot for the following transfer function, 10

$$G(s) = \frac{1}{s(10s + 1)}$$

What is magnitude of $G(j\omega)$ as ω tends to infinity.

(b) Draw the bode plot for the following system and find the gain and phase margin for it, 10

$$G(s) = \frac{s + 100}{(s + 10)(s + 400)}$$

X-----X-----X----X