Even Semester –Jan-May'2024   Session: 2023-24   MBPE- 1ˢᵗ Year
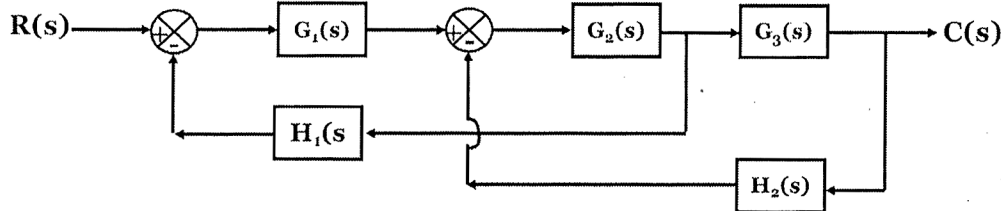
Subject: Bio-Process Dynamics and Control (PG/BPE/T/122A)

Time: 3 hr   Full Marks: 100

(Attempt all questions)

		Marks
	CO1	
Q1	Point out the controlled variable, manipulate variable, controller, set point, sensor, final control element and disturbances in case of a human being driving a bicycle through sketch. How to diminish the disturbances in this control system?	10
	CO2	
Q2	a) Solve the solving following differential equation by Laplace transform $\frac{d^2x}{dt^2} - 6\frac{dx}{dt} + 15x = 2\sin 3t;\qquad x(0) = -1;\ x'(0) = -4$ b) Explain the unit impulse through proper example.	15 2
Q3	A step change of magnitude 4 is introduced into the system having the transfer function $$G(s) = \frac{Y(s)}{f(s)} = \frac{10}{s^2+1.2s+4}$$ Determine the fraction overshoot, period of oscillation, maximum and ultimate values of Y(t).	15
Q4	a) Derive the transfer function of mercury in glass thermometer with suitable notations and assumptions. b) Deliberate the significance of resistance in water tank level system.	10 2
	CO3	
Q5	a) Give the merits and demerits of various type of controllers. b) Consider the characteristic equation of a control system given by $s^3 + (K + 0.5)s^2 + 4Ks + 50 = 0$. Find the value of K for the system to have sustained oscillation.	6 10
Q6	a) Differentiate the servo and regulator problem. Derive the offset value for Proportional controller during regulator problem. b) Why does offset typically occur with P-only control and not with PI control? c) What will be happen if you use derivative action for any control system? Explain.	16 2 2
	CO4	
Q7	Derive the transfer function C(s)/R(s) for the control system shown below figure 	10