Seat No.: _____   www.FirstRanker.com   Enrolment No.www.FirstRanker.com

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2160407   **Date:16/05/2019**

Subject Name:Instrumentation and Control for Bioengineering

Time:10:30 AM TO 01:00 PM   **Total Marks: 70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Derive response equation for step change in case of first order system.	**03**
	(b)	Discuss the concept of transfer function.	**04**
	(c)	Define: a. Sensitivity b. Hysteresis c. Measuring lag d. Static Error e. Dynamic Error f. Reproducibility g. Repeatability	**07**

Q.2	**(a)**	Derive the transfer function for none inter acting multi capacity system.	**07**
	(b)	Solve the following differential equation by Laplace transform $$\frac{d^3x}{dt^3} + 2\frac{d^2x}{dt^2} - \frac{dx}{dt} - 2x = 4 + e^{2t} \quad x(0) = 1 \ x'(0) = 0 \ x''(0) = -1$$	**07**

OR

	(b)	Derive the transfer function of Mercury thermometer with suitable assumptions.	**07**

|			
Q.3	**(a)**	Explain feedback system with suitable example.	**03**
	(b)	Explain advantages and disadvantages of higher gain K_C.	**04**
	(c)	The transfer function of the second order control system is given as, $$G(s) = \frac{16}{1.5s^2 + 2.4s + 6}$$ A step change of magnitude 5 is given in the input variable. Determine, 1) Overshoot 2) Rise time 3) Period of oscillation 4) Maximum value of response	**07**

OR

Q.3	**(a)**	Define damping parameter and give its significance	**03**
	(b)	Derive the transfer function of mixing process.	**04**
	(c)	Find C/R for the given control system	**07**
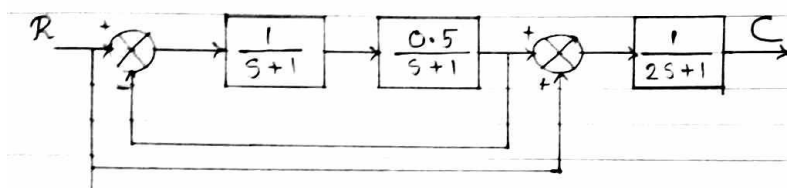
Q.4	**(a)**	Determine the value of K_c for which the system is stable also find the pair of roots for which the system is just unstable $$G(s) = \frac{K_c}{(s + 1)\left(\frac{s}{2} + 1\right)\left(\frac{s}{3} + 1\right)}$$	**07**
	(b)	The open loop transfer function of a control system is given as, $$G(s) = \frac{K_c(0.5s + 1)}{s(s + 1)(s + 0.5)}$$ Sketch the root locus diagram of the control system. Indicate open loop poles and zeros, breakaway point, asymptotic lines, the direction in which the loci travel.	**07**

OR

Q.4	**(a)**	Discuss the transfer function for P, PI and PID controller and its merits and demerits.	**07**
	(b)	Sketch the Bode diagram for a system having transfer function	**07**

$$G(s) = \frac{K_c}{(10s + 1)(0.5s + 1)}$$

Q.5	**(a)**	How is the gauge pressure and absolute pressure measured by liquid manometer?	**03**
	(b)	Explain the principle of variable head meter for flow measurement with suitable example.	**04**
	(c)	Explain principle, construction and derive flow equation of venturi meter with neat sketch.	**07**

Q.5	**(a)**	Describe various viscosity measurement methods	**03**
	(b)	Explain bubbler system for liquid level measurement.	**04**
	(c)	Write a note on Bellows differential pressure element with neat sketch.	**07**

****