Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– V EXAMINATION – SUMMER 2020

Subject Code: 2150305 **Date:27/10/2020**

Subject Name: MODELLING & SIMULATION OF PHYSIOLOGICAL SYSTEMS

Time: 02:30 PM TO 05:00 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)**	List the applications of physiological modelling.	**03**
	(b)	Discuss the dissimilarities of physiological control system with engineering control system.	**04**
	(c)	Explain the oculomotor muscle model with appropriate diagrams.	**07**
Q.2	**(a)**	Draw the cardiac output and venous return curves.	**03**
	(b)	Derive mathematical formulas of linear model of muscle mechanics.	**04**
	(c)	Draw and explain the black box model of neuromuscular stretch reflex with necessary equations and result graphs.	**07**
		OR	
	(c)	Draw and explain the graphs of steady-state response of muscle stretch reflex.	**07**
Q.3	**(a)**	Draw & analyze the steady-state response of Glucose-Insulin model.	**03**
	(b)	Equate mathematical formulas of gas exchange model.	**04**
	(c)	Draw and analyze the graphs showing steady-state of respiratory control mechanics.	**07**
		OR	
Q.3	**(a)**	Draw & analyze the time domain response of Glucose-Insulin model.	**03**
	(b)	"The negative feedback in physiological control system is embedded within the characteristics of the system." Justify the statement with appropriate example.	**04**
	(c)	Discuss the process of modelling with characteristics of good model.	**07**
Q.4	**(a)**	List advantages of distributed parameter model with appropriate application.	**03**
	(b)	Describe the experimental procedure for measurement of neuromuscular reflex motion.	**04**

(c) Discuss various descriptors of impulse and step response of linearized respiratory mechanics model in terms of time domain characteristics. 07

OR

Q.4 (a) List advantages of lumped parameter model with appropriate application. **03**

(b) Draw the strength-duration curve for a neuron. What part does the electrical resistance of membrane performs? **04**

(c) Draw and differentiate the steady-state graphs of single and double feedback loop of cardio vascular variability model. **07**

Q.5 (a) Define mean circulatory pressure with necessary equations. **03**

(b) Derive mathematical representation of venous return using mean circulatory pressure. **04**

(c) Derive the mathematical formulas of time to Peak Overshoot and maximum velocity for Westheimer's saccadic eye movement model. **07**

OR

Q.5 (a) List out the assumptions made by Westheimer for developing saccadic eye movement model. **03**

(b) Draw and explain the Westheimer's saccadic eye movement model with the transfer function. **04**

(c) Explain the model of respiratory sinus arrhythmia with necessary graphs. **07**

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