

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
