

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – SUMMER 2015****Subject Code: 150304****Date: 15/05/2015****Subject Name: Modeling and Simulation of Biological Systems****Time: 2.30PM-5.00PM****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) Explain the requirement of modeling of physiological systems with appropriate examples. **07**
- (b) Draw and explain linear model of muscle mechanics with necessary equations. **07**
- Q.2** (a) Draw and explain the westheimer's saccadic eye movement model & derive equations for peak velocity and peak overshoot. **07**
- (b) Explain the gas exchanger model with appropriate mathematical representation. **07**
- OR**
- (b) Explain the linearized respiratory mechanics model. **07**
- Q.3** (a) Explain the model of respiratory sinus arrhythmia with necessary graphs. **07**
- (b) Draw and explain the responses of glucose-insulin model with necessary graphs. **07**
- OR**
- Q.3** (a) Draw and explain linear model of respiratory mechanics with necessary equations. **07**
- (b) Describe generalized second-order closed-loop model with any one example of physiological system. **07**
- Q.4** (a) Draw and explain the frequency responses of the circulatory control model under below given conditions. **07**
1. normal heart rate control
 2. complete β -adrenergic blockade
 3. complete parasympathetic blockade
- (b) Explain the principle of superposition with its application in art of modeling. **07**
- OR**
- Q.4** (a) Give difference between engineering and physiological control systems with examples. **07**
- (b) Describe the generalized system properties for development of gray-box model. **07**
- Q.5** (a) Write short notes on **07**
1. Oculomotor muscle model
 2. Linear muscle model
- (b) Distributed-parameter versus Lumped-parameter models. **07**
- OR**
- Q.5** (a) Draw and explain steady-state closed-loop analysis of cardiac output regulation during **07**
1. Normal resting conditions
 2. Moderate exercise and
 3. Compensated heart failure
- (b) Draw and explain the model of neuromuscular reflex motion with appropriate equations. **07**
