# GUJARAT TECHNOLOGICAL UNIVERSITY
### B.E. Sem-V$^{th}$ Examination December 2010

## Subject code: 150304
## Subject Name: Modeling and simulation of Biological Systems

Date:  21 /12 /2010                                    Time:  03.00 pm - 05.30 pm

**Total Marks: 70**

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

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| **Q.1** | **(a)** | What are the differences between engineering and physiological control systems? | **07** |
| | **(b)** | Explain muscle stretch reflex as a physiological control system. | **07** |
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| **Q.2** | **(a)** | Determine the steady-state operating point in the model of muscle stretch reflex, with the help of a neat diagram. | **07** |
| | **(b)** | Derive the mathematical formulations for the linear model of lung mechanics. | **07** |

**OR**

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|---|---|---|---|
| | **(b)** | Derive the mathematical formulations for the linear model of skeletal muscle. | **07** |
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| **Q.3** | **(a)** | Write a short note on the superposition principle. | **07** |
| | **(b)** | What is Starling's law? Explain the cardiac output curve with neat diagrams. | **07** |

**OR**

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| **Q.3** | **(a)** | Explain the regulation of glucose with the help of neat diagrams. | **07** |
| | **(b)** | Write about the gas exchanging component in the chemical regulation of ventilation. | **07** |
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| **Q.4** | **(a)** | Explain the frequency response of a model of circulatory control. | **07** |
| | **(b)** | Draw the block diagram showing dynamics of neuromuscular reflex model and its simulink implementation. | **07** |

**OR**

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|---|---|---|---|
| **Q.4** | **(a)** | Explain the frequency response of glucose-insulin regulation. | **07** |
| | **(b)** | Derive all the equations showing the dynamics of the neuromuscular reflex motion with suitable diagrams. | **07** |
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| **Q.5** | **(a)** | What is a saccade? What are the different types of eye movements executed by the occulomotor system? | **07** |
| | **(b)** | Derive the equation of peak overshoot in Westheimer's model for saccadic eye movement. | **07** |

**OR**

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| **Q.5** | **(a)** | Explain recording of electrical activity during a saccade. | **07** |
| | **(b)** | Explain the four parts of occulomotor muscle model. | **07** |

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