

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-V (OLD) • EXAMINATION – WINTER 2017**

**Subject Code:150304**

**Date: 30-11-2017**

**Subject Name: Modelling & Simulation of Biological systems**

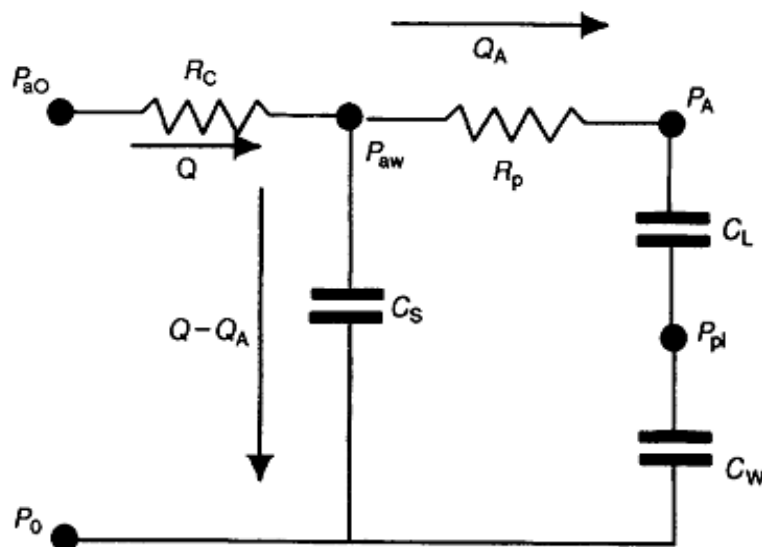
**Time: 10:30 am to 01:00 pm**

**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) Give differences between engineering control system and physiological control system. **07**  
(b) Give difference between open loop and closed loop control system. Give two examples of each. **07**
- Q.2** (a) Draw and explain linear model of muscle mechanics, derive the equation of force for steady state isometric condition. **07**  
(b) Develop the mechanical equivalent of the electrical analog of respiratory mechanics shown in below given figure. **07**



**OR**

- (b) Draw and explain the linear model of respiratory mechanics. Derive the equation for Pao and Q. **07**
- Q.3** (a) Draw & explain time response and frequency response of glucose-insulin model for normal and type-2 diabetic patient. **07**  
(b) Describe cardiac output regulation with help of model and cardiac output curves **07**
- OR**
- Q.3** (a) With neat figure describe linearized dynamic model of chemo reflex control of ventilation **07**  
(b) Explain with neat diagram wetheimer's saccade eye model. **07**
- Q.4** (a) Explain adaptive characteristics of muscle stretch reflex **07**  
(b) Explain superposition theorem and show how it is used to identify whether the system is linear or nonlinear. **07**
- OR**
- Q.4** (a) Explain oculomotor eye muscle model with neat diagram. **07**  
(b) Explain difference between time domain and frequency domain approach. **07**

- Q.5** (a) Explain distributed and lumped parameters with examples. Derive the equation for intracellular voltage along the nerve fiber. **07**
- (b) Draw simulink model of muscle stretch reflex. **07**
- OR**
- Q.5** (a) With help of neat diagram explain cardiopulmonary model. **07**
- (b) Explain with diagram that pupillary light reflex is classic example of positive or negative feedback control systems. **07**

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