

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII • EXAMINATION – WINTER 2013****Subject Code: 170302****Date: 05-12-2013****Subject Name: Physiological System Modeling****Time: 10.30 am - 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 a difference between static vs. dynamic analysis of model. **04**
 (b) Briefly describe westheimer's saccadic eye movement model and derive the equations for time to peak overshoot (t_p) & time at peak velocity (t_{mv}). **10**

- Q.2** (a) Draw and discuss the result plots of simple lung mechanics model for 15 & 60 breaths/min. What effects does the model depicts while increasing the frequency of respiration ventilator? **07**
 (b) Estimate the steady-state operating point for simple model of the muscle stretch reflex. **07**

OR

- (b) Draw a velocity vs. time graph for 10° saccade. Label and explain below given terminologies. **07**
1. Latent Period
 2. Saccade Duration
 3. Peak Velocity
 4. Time at peak velocity
 5. Saccade magnitude

- Q.3** (a) Draw & explain the effects of atropine and propranolol on frequency responses of the circulatory control model and derive a conclusion for the results. **07**
 (b) Draw & explain the venous return curves with factors affecting slope and positions. **07**

OR

- Q.3** (a) Draw and explain steady state analysis of glucose regulation under normal conditions. Using the same model of glucose regulation, estimate the steady-state glucose and insulin levels in a patient with an abnormally high gain in the insulin response to glucose. Assume β to be twice as large as its normal value. **07**
 (b) Draw & explain the cardiac output curves with factors affecting slope and positions. **07**

- Q.4** (a) Draw and explain the impulse response and step response descriptors. **07**
 (b) Draw the SIMULINK implementation of neuromuscular reflex model and sample result graphs. **07**

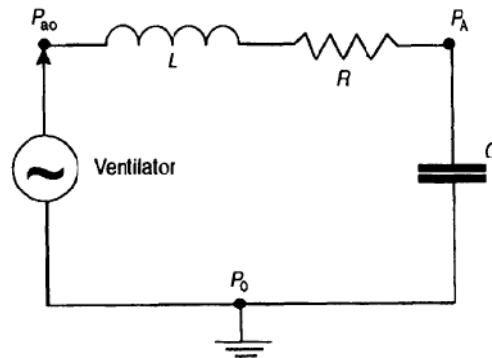
OR

- Q.4** (a) Draw and derive the mathematical expressions for below listed components of neuro-muscular reflex model. **07**
- a) Limb Dynamics
 - b) Muscle Model
 - c) Muscle Spindle model
- (b) Describe the effects of respiratory system on heart rate. Draw a SIMULINK model of circulatory control. **07**

- Q.5** (a) Draw a model of pendulum and the result curves. From the graphs, what can we **04**

conclude?

- (b) Determine the frequency responses of the ventilatory control model shown in figure, assuming 10
- $\alpha = 0$ (no rate sensitivity);
 - $\alpha = 1/2$ (lag-lead feedback); and
 - $\alpha = 2$ (lead-lag feedback).



OR

- Q.5 (a) Enlist the outcomes and limitations of westheimer's saccadic eye movement model. How does the robinson's model overcome those limitations? 04
- (b) Rising suddenly from a reclining to standing position sometimes causes a feeling of faintness due to a decrease in blood flow to the brain. However, in the normal person, this is quickly compensated for by adjustments in the circulation. Although cardiac output and venous return curves reflect steady-state responses, they remain useful for providing a qualitative picture of the sequence of events accompanying the change in posture. Explain how the cardiac output and venous return curves are affected at each stage of the response. Also, describe how cardiac output and right atrial pressure are changed. 10
- Rising suddenly causes extra blood to be stored in the veins of the legs.
 - The drop in blood pressure is sensed by the baro-receptors, which lead to an increase in generalized sympathetic outflow. This increases heart rate and cardiac contractility as well as peripheral resistance.
 - Finally, venoconstriction restores mean systemic pressure back toward its normal level.
