

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII • EXAMINATION – SUMMER 2013

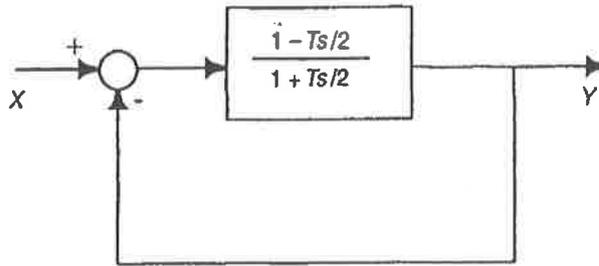
Subject Code: 170302**Date: 24-05-2013****Subject Name: Physiological System Modeling****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

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

- Q.1** (a) Explain the method to reduce the effects of external disturbances. **07**
 (b) Obtain the equations that represent the block diagram of neuromuscular reflex model. **07**
- Q.2** (a) Derive the equations for transient response of first order BIBO system. Discuss the stability criteria for BIBO system. **07**
 (b) Draw & explain westheimer's saccadic eye movement model. **07**
- OR**
- (b) Explain robinson's model with agonist & antagonist neurological control signal. **07**
- Q.3** (a) Justify the statement. "For a stable system, there should be no changes in sign in the first column of the array of Routh-Hurwitz's matrix." **07**
 (b) What is a forward problem? State the techniques for system identification. **07**
- OR**
- Q.3** (a) Draw and explain Nyquist plots for the linear lung mechanics model with proportional feedback with feedback gains as $k = 1, 10$ and 100 . **07**
 (b) Draw and explain the mechanical analogy of lung mechanics model with appropriate equations. **07**
- Q.4** (a) Draw and explain the effects of atropine and propranolol on frequency responses of the circulatory control model. **07**
 (b) Briefly explain the chemical regulation of ventilation with neat diagrams. **07**
- OR**
- Q.4** (a) Draw and explain the model of cardiac output regulation. **07**
Q.4 (b) Draw and explain the time response and frequency response of glucose-insulin regulation model for normal and type-2 diabetic patient. **07**
- Q.5** (a) Give a difference between Engineering & Physiological Control System. **04**
 (b) The following transfer function is one of the simplest linear approximations to the pure time delay, T : **10**

$$H(s) = \frac{1 - \frac{T_s}{2}}{1 + \frac{T_s}{2}}$$

Determine the open-loop and closed-loop responses for the system shown in figure, when the input is a unit step.



OR

- Q.5 (a) Give a difference between Distributed and Lumped parameter. 04
- (b) Determine the response in angular displacement of the eye in the figure, if the target input θ_{ref} were to follow the trajectory of a unit ramp, i.e., $\theta_{ref} = t$ ($t > 0$). 10
 How would this ramp response be affected if the velocity feedback gain, k_v , were made negative?

