Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER • 2014

Subject Code: 170302 Date: 02-12-2014

Subject Name: Physiological System Modeling

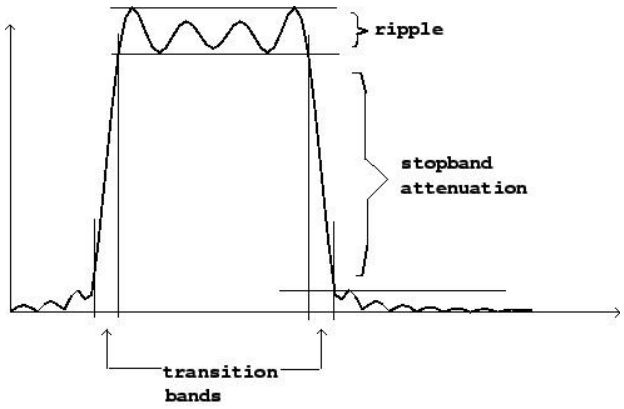
Time: 10:30 am - 01:00 pm Total Marks: 70

Instructions:

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

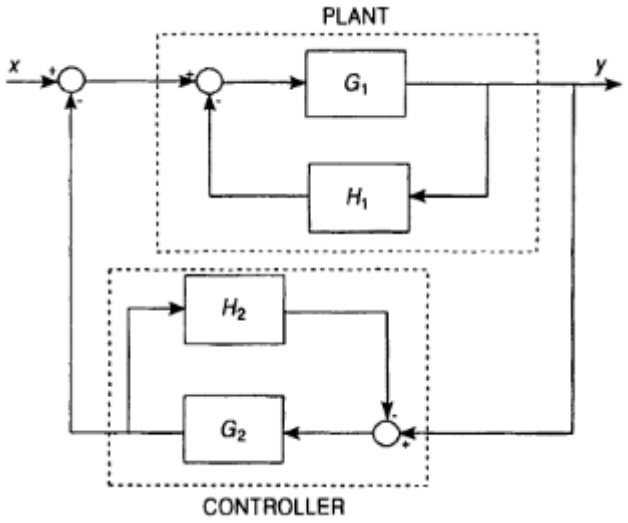
Q.1	**(a)**	Give a difference between static and dynamic analysis of physiological systems.	**07**
	(b)	Draw and explain distributed and lumped SIMULINK model of simple lung mechanics.	**07**
Q.2	**(a)**	Explain the requirement of modeling of physiological systems with appropriate examples.	**07**
	(b)	Draw and explain linear model of respiratory mechanics with necessary equations.	**07**
		OR	
	(b)	Draw and explain linear model of muscle mechanics with necessary equations.	**07**
Q.3	**(a)**	Derive the equilibrium point for muscle stretch reflex model with nonlinear characteristics.	**07**
	(b)	Draw and explain the simplified model of cardiac output regulation with cardiac output and venous return curves.	**07**
		OR	
Q.3	**(a)**	Draw and explain steady-state closed-loop analysis of cardiac output regulation during A. Normal resting conditions B. Moderate exercise and C. Compensated heart failure	**07**
	(b)	Briefly describe the frequency response of glucose-insulin model with necessary graphs.	**07**
Q.4	**(a)**	Write short notes on (a) Oculomotor muscle model (b) Linear muscle model	**07**
	(b)	Draw the SIMULINK model of respiratory sinus arrhythmia with required graphs.	**07**
		OR	
Q.4	**(a)**	Write the methods of system analysis and describe the process of identification of a close-loop system.	**07**
	(b)	Explain the westheimer's saccadic eye movement model and derive equations for peak overshoot and peak velocity.	**07**
Q.5	**(a)**	Draw and explain the frequency responses of glucose-insulin model with necessary graphs.	**07**
	(b)	Define stability of any one physiological system. Explain the criteria for stability analysis.	**07**
		OR	

Q.5 **(a)** Suggest and justify a system analysis technique for a close-loop system with below given frequency response. **04**



(b) Below figure shows the block diagram of a sophisticated biomedical device for regulating the dosage of anesthetic gases being delivered to a patient during surgery. Note that the plant and controller are themselves feedback control systems. **10**

a) Derive an expression for the *open-loop gain* of the overall control system.
b) Derive an expression for the *closed-loop gain* of the overall control system.
c) If G_1= 1, G_2=2, H_1 = 1, and H_2=2, what is the *loop-gain* of the overall system?



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