GANPAT UNIVERSITY

B. Tech. Semester: V (BM&I) Engineering

CBCS Regular Examination Nov – Dec 2015

2BM501 Physiological Control Systems & Modeling

Time: 3 Hours   Total Marks:

Instruction: 1. Write each section in separate answer book.
2. Answer should be brief and to the point.
3. Figures on right indicate marks.

Section - I

Que. – 1	**Answer the following questions:**	12
a)	Write the name of library for the following blocks in MATLAB SIMULINK: i) Sine Wave ii) Floating Scope iii) Add	03
b)	Define "Homeostasis". What is positive feedback and negative feedback in physiological control system? Give the example of it.	04
c)	Explain how physiological control systems are adaptive. Draw the functional block diagram of it.	05

OR

Que. – 1	**Answer the following questions:**	12
a)	What is extensive degree of cross coupling among different physiological control system? Draw and explain by using example.	06
b)	Draw and explain linearized physiological model of skeletal muscle. Also derive its mathematical equation.	06

Que. – 2	**Answer the following questions:**	11
a)	Draw and explain the resistive and capacitive property for mechanical and fluidic system. Compare it with Ohm's law.	05
b)	Define "Cardiac Output". Draw and explain the simplified model of cardiac output regulation. Also derive its mathematical expression.	06

OR

Que. – 2	**Answer the following questions:**	11
a)	What is venous return in cardiac output regulation? Explain venous return curve with mathematical proof.	05
b)	Differentiate lumped parameter model and distributed parameter model. Explain it by using the example of passive cable characteristics of an unmyelinated nerve fiber?	06

Que. – 3	**Answer the following questions:**	12
a)	What is type I and type II diabetes? Enlist the major ways through which glucose is eliminated from blood. Draw the schematic representation of the process involved in the regulation of glucose and insulin and explain in detail.	07
b)	Determine the steady state operating point for muscle stretch reflex model components.	05

Que. – 4   **Answer the following questions :**

a) Derive the linear electrical model of respiratory mechanics. Also derive the transfer function of the system and represent it in open loop and closed loop configuration.

b) Draw and explain the SIMULINK model of respiratory mechanics by using overall system transfer function.

OR

Que. – 4   **Answer the following questions :**

a) Draw and explain the SIMULINK model of respiratory mechanics by using the differential equation relating total airflow (Q), to the airway opening pressure (P_{ao}).

b) Briefly explain the mathematical modeling and simulation of artery, vein and cardiovascular system.

Que. – 5   **Answer the following questions :**

a) What is the significance of Root Locus? Explain the procedure to sketch the root locus plot with the help of suitable example

b) For the linear lung mechanics model with Proportional feedback, determine the conditions which must be satisfied by the co-efficient of the characteristics equation for the system to be stable.

OR

Que. – 5   **Answer the following questions :**

a) What is root locus? Sketch the root locus plot for the linear Lung mechanics model with the following parameters.

$$T.F = \frac{10}{LCs^2 + RCs + 1} , \; L = 0.0001 \; cmH_2Os^2, \; R=0.101 \; cmH_2Os \; L^{-1} \; c=1 \; LcmH_2O^{-1}$$

b) Derive the Transfer function of Pupillary Light Reflex model and determine the conditions which must be satisfied by the co-efficient of the characteristics equation for the system to be stable.

Que. – 6   **Answer the following questions :**

a) What is the requirement of standard test signals? Explain the different types of standard test signals used to analyze the time response of a control system.

b) What is the significance of Polar plot? Explain the procedure to sketch the polar plot.

c) What is Gain cross-over frequency and Phase cross-over frequency in Bode plot? How it will affect on the stability of the system.

END OF PAPER