GANPAT UNIVERSITY

B. Tech. Semester: V (Biomedical & Instrumentation) Engineering
CBCS Regular Examination November – December 2014
2BM501 Physiological Control Systems & Modeling

Time: 3 Hours

Total Marks: 70

Instruction:
1. Write each section in separate answer book.
2. Figures to the right indicate marks.
3. Assume suitable data, if necessary.
4. Answer should be brief and to the point.

Section – I

Que. – 1 **12**

a) What is extensive degree of cross coupling among different physiological control system? Draw and explain by using example.

b) Draw and explain the resistive and capacitive property for mechanical and fluidic system. Compare it with Ohm's law.

OR

Que. – 1 **12**

a) Explain how physiological control systems are adaptive. Draw the functional block diagram of it.

b) Draw the models of parallel and series combinations of mechanical dashpots for resistances and springs for compliances along with mathematical expression.

Que. – 2 **11**

a) Define 'cardiac output'. Draw and explain the simplified model of cardiac output regulation.

b) Draw and explain linear model of skeletal muscle. Also derive its mathematical equation.

OR

Que. – 2 **11**

a) Draw and explain venous return curve.

b) Draw the steady state model of the chemical regulation of ventilation and CO_2 exchange in the lungs. Explain and derive the equations of it.

Que. – 3 **12**

a) Draw the block diagram displaying the steady state characteristics of the muscle stretch reflex model components and explain the procedure for determination of steady state operation point.

b) Enlist three 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.

12

Que. – 4

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) 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.

OR

12

Que. – 4

a) What is the significance of time response analysis of control system? List out the steps to perform the time response analysis of the physiological control systems.

b) Draw and explain the time response of second order system subjected to unit impulse input.

11

Que. – 5

a) For the linear lung mechanics model with integral feedback (k/s), determine the conditions which must be satisfied by the co-efficient of the characteristics equation for the system to be stable.

b) What are the methods to identify the stability of linear physiological control systems? Explain the significance of each method.

OR

11

Que. – 5

a) Explain the procedure to sketch the Root locus plot with the help of suitable example.

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

12

Que. – 6

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

$$T.F = \frac{10}{LCs^2 + RCs + 1}$$

Where L = 0.0001 cmH_2Os^2, R=0.101 $cmH_2Os\ L^{-1}$ c=1 $LcmH_2O^{-1}$

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

END OF PAPER