

GANPAT UNIVERSITY

B.Tech. Sem V (BM & I) Regular Examination NOV./DEC. -2010
BME-502 Biological Control Systems and Modeling

Max Time: 3 hours

Max Marks: 70

Instructions:

1. Answers to the 2 sections must be written in the separate answer books.
2. Figures to the right indicate marks.
3. Conventional terms or notations are used.

SECTION-I

- Q-1
- (a) Give the key difference between engineering and physiological control system. [06]
- (b) What is the chemical regulation of ventilation? Explain the respiratory controller system of ventilator control system. [06]
- OR**
- Q-1
- (a) Explain in detail the science of modeling. [06]
- (b) In detail discuss the gas exchange system of ventilator control system. [06]
- Q-2
- (a) What do you mean by cardiovascular system? Discuss the heart model and derived the equations of dynamic flow. [06]
- (b) Draw the equivalent mechanical model of pulmonary mechanics model and obtained the equation that describe the dynamic behavior of the system. [06]
- OR**
- Q-2
- (a) Draw the pneumatic analog of pulmonary mechanics and discuss chest wall and airways. [06]
- (b) Draw and explain the second order Westheimer's Saccadic eye movement model. [06]
- Q-3
- (a) What is the importance of parameter estimation and sensitivity analysis? Explain the parameter estimation and sensitivity analysis for physiological system. [05]
- (b) What is the objective of pulmonary system modeling? Make a list of all components in equivalent pneumatic model of pulmonary system. [06]

SECTION-II

- Q-4**
- (a) Draw and differentiate lumped and distributed parameter models for the lung mechanism using SIMULINK. [08]
- (b) Mention the name of library for the following blocks in SIMULINK: [04]
- i) Transfer Function ii) Saturation
iii) Pulse Generator iv) Constant
- OR**
- Q-4**
- (a) Draw the models of parallel and series combinations of mechanical dashpots for resistance and springs for compliance. Explain and derive mathematical formulation. [06]
- (b) Draw and explain the simplified model of cardiac output regulation. Also derive its mathematical expression [06]
- Q-5**
- (a) 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. Make the SIMULINK model [08]
- (b) How the physiological control systems are adaptive? [04]
- OR**
- Q-5**
- (a) What is the relationship between lumped parameter and distributed parameter models of passive cable characteristics of an unmyelinated nerve fiber? Explain in detail. [06]
- (b) Draw the model of neuromuscular reflex motion and explain in detail. [06]
- Q-6**
- (a) Determine the steady state operating point of muscle stretch reflex model along with its graphical representation. [06]
- (b) Draw and explain venous return curve. [05]

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