GANPAT UNIVERSITY

B. Tech. Semester: VIII (Biomedical & Instrumentation) Engineering
Regular Examination April – June 2016
2BM803 Transportation Phenomena in Living Systems

Time: 3 Hours

Total Marks: 70

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

Section – I

Que. – 1

a) Draw the functional block diagram of dialysis system. Explain in detail. 05

b) Differentiate Heat and Temperature. What is the effect of temperature in heat transfer? 04

c) Draw the schematic arrangement of tissue control volume as used in CHEN – HOLMES model. Explain. 03

OR

Que. – 1

a) Which are the various ways through which human body can maintain a thermal balance? 06

b) What are the assumptions and shortcoming of Pennes bioheat model? What are the different requirement / condition maintained during the experiment of Pennes model? 06

Que. – 2

a) Why is the heat of vaporization more at body temperature? Also give a mathematical proof. 06

b) What is Biomedical Mass Transport? Analyze the respiration gas transport process.
What is the % concentration of O_2 and CO_2 during inspiration and expiration? 05

OR

Que. – 2

a) Draw & explain the neat diagram for mass transfer across systemic capillaries. Show the relationship between inlet and outlet flow of liquids across the capillaries for constant osmotic pressure and decreasing hydrostatic pressure. 06

b) Explain the concept of mass transport through kidney with neat diagram. 05

Que. – 3

a) Explain how human body maintains thermal balance using conduction heat transfer? Give the example of same.
Write the mathematical equation and calculate the heat transfer rate for the area of human body about 1.8 m^2 06

b) Draw the structure of blood perfused tissue and explain in detail. Show the temperature equilibration between blood and tissue.   06

Section – II

Que. – 4

a) Give some necessary equations for mass transfer in blood and tissues.   06

b) Explain oxygen transport in human body with necessary equations.   06

OR

Que. – 4

a) Describe basic types of fluid flow with necessary equations and figures.   06

b) Explain the diffusion of O_2 and CO_2 across the alveolar capillary membrane.   03

c) Define: 1) Mass transfer 2) Diffusion 3) Osmosis   03

Que. – 5

a) What determines the diffusion coefficient? Explain in detail.   05

b) Calculate the rate of heat loss through the vertical walls of a boiler furnace of size 4 meter by 3m by 3m high. The walls are constructed from an inner fire brick wall 25 cm thick of thermal conductivity 0.4 W/mK, a layer of ceramic blanket insulation of thermal conductivity 0.2 W/mK and 8 cm thick, and a steel protective layer of thermal conductivity 55 W/mK and 2 thick. The inside temperature of the fire brick layer was measured at 600 degree C and the temperature of the outside of the insulation 60 degree C. Also find the interface temperature of layers.   06

OR

Que. – 5

a) From where does $E_b = \sigma T^4$ come? Derive it.   06

b) Biomedical application of heat Convection and heat radiation   05

Que. – 6

a) Describe mass transport in Liver.   06

b) Explain structure and function of lungs.   06

END OF PAPER