MODELING OF PHYSIOLOGICAL SYSTEM (SEMESTER - 8)

CS/B.TECH (BME)/SEM-8/BME-802/09

ENGINEERING & MANAGEMENT EXAMINATIONS, APRIL – 2009
MODELING OF PHYSIOLOGICAL SYSTEM (SEMESTER - 8)

Time : 3 Hours]   [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1.   This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2.   a)   In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
     b)   For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3.   **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4.   Read the instructions given inside carefully before answering.
5.   You should not forget to write the corresponding question numbers while answering.
6.   Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
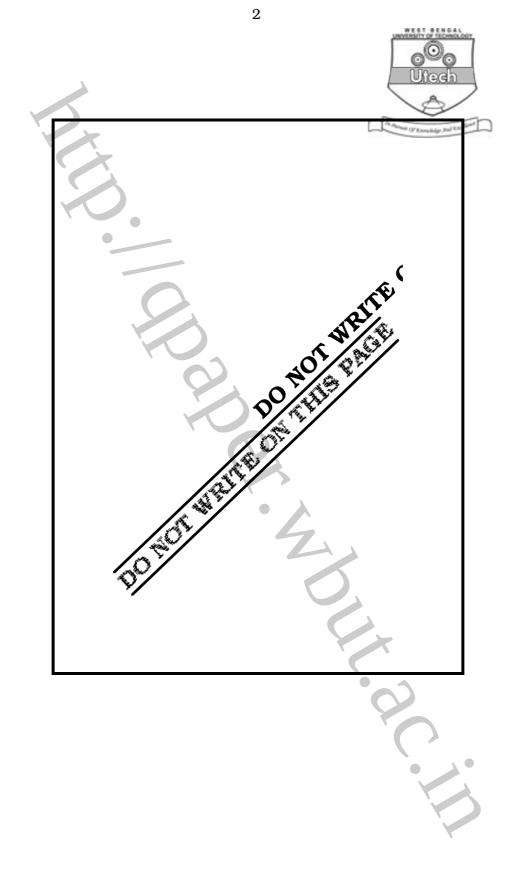7.   **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8.   You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9.   Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY
Marks Obtained

Question Number	Group – A							Group – B		Group – C			Total Marks	Examiner's Signature
Marks Obtained														

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Head-Examiner/Co-Ordinator/Scrutineer

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SEMESTER - 8

Time : 3 Hours]   [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)
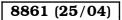
1.   Choose the correct alternatives for the following :   10 × 1 = 10

   i)   Compartmental models are

   a)   lumped model   b)   continuous time model

   c)   both (a) and (b)   d)   none of these.

   ii)   In electrical analogue model, pressure changes are considered as

   a)   current changes   b)   resistance changes

   c)   potential changes   d)   none of these.

   iii)   Neural network model is an example of

   a)   black box model

   b)   building block model

   c)   none of these.

   iv)   The cell membrane potential with distance

   a)   increases   b)   decreases

   c)   remains constant   d)   none of these.

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v) Which one is the correct one for muscle force (M.F.) ?

   a) Active M.F. = Stimulatd M.F + Passive M.F.

   b) Active M.F. = Stimulated M.F. – Passive M.F.

   c) Active M.F. = Stimulated M.F. / Passive M.F.

   d) None of these.

vi) If the capacitive current of a cell membrane I_c , membrane capacitance C_m and change of membrane potential with time (t) is $\frac{dv_m}{dt}$, then what will be the membrane current (I_c) expression ?

   a) $I_c = \frac{dv_m}{dt} \frac{1}{C_m}$

   b) $I_c = C_m \frac{dv_m}{dt}$

   c) $I_c = \frac{dv_m}{dt}$

   d) none of these.

vii) The Nernst potential for a particular cation is calculated by the equation [e = conc. of extra cellular fluid, i = conc. of intra cellular fluid]

   a) $E_x = \frac{RT}{q} \, ln \frac{[x^+]_e}{[x^-]_i}$

   b) $E_x = \frac{RT}{q} \, ln \frac{[x^+]_i}{[x^-]_e}$

   c) $E_x = \frac{RT}{q} \, ln \frac{[x^+]_e}{[x^+]_i}$

   d) $E_x = qRT \, ln \frac{[x^+]_e}{[x^-]_i}$.

viii) Building block models are derived by applying

   a) input-output relationship

   b) internal functioning of the system

   c) fundamental laws

   d) none of these.

ix) O_2 consumption (ml / min / 100 gm) in kidney is

   a) 2·2

   b) 6·8

   c) 3·7

   d) none of these.

x) The full form of RBR is

   a) Renal Vessel Resistance

   b) Renal Valve Resistance

   c) Renal Vascular Resistance

   d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Describe the model of whole neuron step by step and also apply the Kirchhoff's current law for each step.

3. Explain the purpose and characteristics of physiological modeling.

4. Describe the linearization process of a non-linear model.

5. Briefly describe the 'voltage clamp experiment' done by 'Hodgkin and Huxley'.

6. Briefly explain about the electrical analogue model of blood flow.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions. 3 × 15 = 45

7. What do you mean by the term 'immune response' ? Briefly discuss the linearized model of the immune response to germ cells, plasma cells and antibody. Write down the system equations for the immune response. 3 + 7 + 5

8. What is nerve action potential ? How is it developed ? Draw and briefly discuss about the electrical equivalent circuit of the nerve membrane. Briefly discuss about the step response of 'Potassium conductance' with its non-linear model. 3 + 7 + 5

9. a) Explain the time invariant and time varying systems for physiological modeling with example.

   b) Describe briefly about the model of coronany circulation.

   c) Write down the four compartmental model of bone-cell formation. 6 + 7 + 2

10. a) Write down the cross-bridge theory of muscle contraction.

    b) Briefly explain about the Huxley's model of isotonic muscle contraction. 6 + 9

6

11. a) Briefly explain about the different types of non-linear model.

    b) Why are model specification and estimation important in successful modeling ?

    c) Draw the schematic diagram of EMG-modeling and explain it.   5 + 5 + 5

12. a) Describe the model of Henle's loop for NaCl transport.

    b) How do you measure the renal blood flow (RBF) ? Write down the equation for renal blood flow.   10 + (3 + 2)

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END