



کراچی یونیورسٹی
University of Karachi
Department of Mathematics
MATH 804: Modeling of Biological Systems II

Time Allowed: 2 hours • Maximum Marks: 50 • Date: Wednesday, January 5, 2011 • Paper Format: A

Student's Name _____ (in CAPITAL LETTERS using a "marker")

Attempt all questions. Each part of Question 1 is of 7 marks and that of Questions 2-4 is of 4 marks. Note down the time spent on solving each part of question and time spent on revision by making the following "Time Chart" on the answerbook front page (2 marks). Time spent on revision must be at least 10% of the total time.

Question No.	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	Revision
Time (minutes)											

a) DO NOT TURN PAPER AROUND unless the invigilator says: *Start now*

b) This is a closed-book examination. Deposit all BOOKS, NOTES, MOBILE PHONES (switched off), DIGITAL DIARIES and LAPTOPS in the designated area. Remove everything from your desk, except markers, pens, pencils, stapler and calculator.

c) If you want to use a calculator, **it must bear a "sticker"** displaying your NAME and your SEAT NUMBER, large enough so that it is visible from a distance of 5 meters. **Absolutely, NO sharing of calculators.**

d) Use your own material. **Nothing can be borrowed from or given to** a friend.

e) The papers may be of different formats. Therefore, work on your own **without consulting anyone** (We have a record of your seating arrangement).

f) Write your "NAME" on all pages of **your question paper** (5 marks shall be deducted for failing to comply) [NOTHING ELSE SHOULD BE WRITTEN ON THE QUESTION PAPER] and "PAPER FORMAT" on the front page of **your answerbook** (the upper-right-hand corner) and the **Yellow Sheet** using a "marker". Start your work from **Page 2** of your answerbook. The only thing that could be written on the front page is the "Time Chart" (see above) and the "Honor Statement" (see below).

g) The following statement must be copied on the front page of your answerbook and signed (2 marks): *"My signatures, below, testify that I am the person, whose name and photograph appear on the Admit Card. Upon my honor, I declare that the following work is my own, completed without giving or receiving unacknowledged help, without copying, or the use of any unfair means."* Signatures _____

h) This paper contains TWO PAGES (this page and the back page). On invigilator's signal (*Start now*) turn the paper around, check if you have the back page printed, correctly. Last line of the second

page reads: <END>. Start working on the paper, immediately.

i) Put your pens down and your papers turned (so that this page is facing you) and the FRONT PAGE of your answerbook should be facing you as soon as you hear "ALL PENS DOWN". Failure to do as directed shall result in "deduction of 5 marks" from your score.

j) If you use extra copies, it is "**your responsibility**" to write YOUR NAME, COPY NUMBER and all OTHER INFORMATION on each copy used. All the extra copies must be stapled with the main copy, before turning in your paper (you may wish to bring in a stapler with you for this purpose).

k) If you have a question of "Fill in the blanks" in your paper you must write the complete sentence with the filled word underlined.

l) Nobody is allowed to leave the examination hall, **for whatsoever reason**, once the examination has started. Bring your own DRINKING WATER.

m) Students are not allowed to LEAVE THEIR SEATS or STAND UP during the examination. If you have a query, "raise your hand" and someone will help you.

n) All work, including rough work, must be on the official answerbook. No extra sheet may be used.

o) Students are **not** allowed to use RED anywhere. All work (except figures) must be in pen or ballpoint.

p) The result shall be displayed on my homepage on **Saturday, January 8, 2011 at 0900h**. DO NOT contact the Course Supervisor. Students are not permitted to see the answerbooks.

q) Anyone found cheating in the examination should be facing disciplinary action, which may result in **EXPLUSION** or **SUSPENSION** for 2 or more years. **Absolutely, no conversation among students. DON'T TURN THE PAPER, YET. Wait for "signal" from the invigilator.**

Student's Name _____ (in CAPITAL LETTERS using a "marker")

- 1-a) Prove $m = m_a + m_b - m_{a+b}$, where m is nude mass, m_a mass with one set of clothing worn, m_b mass with the other set of clothing worn and m_{a+b} mass with both sets of clothing worn (this formula could be used to compute nude mass without asking the subject to disrobe completely), and write the equivalent formula for computing nude weight.
- 1-b) What is the highest level of accuracy with which height of a person could be measured? When was this achieved and where? Describe the mathematical and the physical techniques involved in achieving this enhanced accuracy.
- 2-a) What are the main assumptions taken by Wright and Kydd to construct linear model of global electrocortical activity? What additional assumption did Kamal, Siddiqui and Husain introduce?
- 2-b) Give a mathematical definition of brain death.
- 3-a) What are the main health risks of full-body scan (backscatter-X-ray screening) at the airport? Why it is neither efficient nor effective? Which groups of population are at the highest risk?
- 3-b) Describe the salient features of airport screening system based on emitted IR and thermal radiation. Are there any health issues involved? Compare and contrast this system with the full-body scan.
- 4-a) Describe briefly mathematical concepts involved in the physical examination performed by a medical doctor.
- 4-b) List 4 techniques used in the physical examination and identify the sense (sight, hearing, etc.) used in these techniques.
- 5) Write short notes on any TWO of the following:
 - a) Anorexia nervosa
 - b) Informed consent (opt in vs. opt out policies)
 - c) Difference between magnetobiology and biomagnetism

Web address of this document: http://www.ngds-ku.org/M803-4/Exams803-4/804-10_Paper.pdf

Exam paper solution: Saturday, January 8, 2011 at 1500h, i. e., 3: 00 p. m., Mathematics G8