



کراچی یونیورسٹی
University of Karachi
Department of Mathematics
MATH 610 • Biomathematics II

Time Allowed: 3 hours • Maximum Marks: 80 • Date: Tuesday, December 7, 2010 • Paper Format: A

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

Questions 1-4 constitute the terminal and 5-7 midterm. Each part of Question 1 is of 4 marks. Questions 2-7 are of 10 marks each. 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	1c	1d	2	3	4	5	6	7	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 **Friday, December 24, 2010 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 as per University of Karachi rules. **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")

TERMINAL

- 1-a) List 4 theoretical features of Wright and Kydd model of global electrocortical activity.
- 1-b) List 4 similarities of moiré fringe topography and rasterstereography.
- 1-c) List 4 diagnostic methods commonly used to detect scoliosis? Why is it necessary that the child should be completely undressed except short underpants to detect trunk deformities?
- 1-d) Lordosis is accentuated curvature in the _____ (*frontal, sagittal, transverse*) plane. In the Wright and Kydd and KSA (Kamal-Siddiqui-Husain) models of global electrocortical activity, electrical activity of the brain is modeled as _____ (*simple, damped, driven*) harmonic oscillator. Trunk deformity is classified as _____ (*severe, intermediate, mild*) if degree of correction of spinal deformity lies between 0.00 and 33.33. Kamal and Siddiqui modeled human heart as a deformed _____ (*paraboloid, spheroid, ellipsoid*) of revolution.
- 2) How would you determine the heart parameters a, b, k by noting down PMI (point of maximum intensity) for sounds generated by the pulmonary valve (P), the tricuspid valve (T) and the mitral valve (M)? Derive mathematical relations.
- 3) Write down the formulae for mean and gaussian curvatures. Prove the formula to compute local curvature (d is the apparent spacing of raster grid, projected on the curved surface, s is the actual spacing):

$$k = \pm \frac{1}{s} \sqrt{6(1 - \frac{d}{s})}$$

- 4) Write short notes on any TWO of the following:
 - a) Stethoscope
 - b) Edge-based raster
 - c) Difference between magnetobiology and biomagnetism

MIDTERM

- 5) Make a table listing steps 5-7 (positions of hip knee, ankle for each leg in each step) of normal gait. Illustrate by drawing diagrams, representing each leg with a different color.
- 6) How are the cardiac coördinates different from the elliptic-cylindrical coördinates? Obtain scale factors for the cardiac coördinates.
- 7) Human body can be modeled as an inverted pendulum, Write down the equation of potential energy of a simple pendulum as a function of angle from the vertical position and obtain the conditions for stable and unstable equilibria.

Web address of this document: http://www.ngds-ku.org/M609-10/Exams609-10/610-10_Paper.pdf
(paper shall be uploaded 12 hours after the examination ends)

Exam paper solution: **Friday, December 24, 2010 at 0940h, i. e., 9: 40 a. m., Mathematics F13**

This paper has been printed in bigger font at the request of a vision-impaired student.