



UNIVERSITY OF KARACHI

Department of Mathematics

MATH 685 • Astronomy I

Course Supervisor: Professor Dr. Syed Arif Kamal

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Time Allowed: 3 hours • Maximum Marks: 100 • Date: Friday, May 29, 2009

Student's Name _____ (in CAPITAL LETTERS using a "marker") • Paper Format A

Attempt **Question 1** and 5 other questions. Each part of **Question 1** is of 4 marks & of **Questions 2-7** is of 8 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	1c	1d	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	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 paper around, check if you have the back

page printed correctly. Last line of the second page is: <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, June 12, 2009** 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) Define longitudes and latitudes in terms of angles in spherical-polar coordinate mesh. Write down the equation(s) of equator and meridian in terms of longitude and latitude.
- 1-b) What is INS? Which inertial sensors are used in INS?
- 1-c) List 6 phases of matter. In the context of astronomy, where do you find each one in abundance.
- 1-d) What are different parts of rocket? Explain each one in 20-25 words.

- 2-a) Describe 2 major accidents of US Space Shuttles with dates. What were the main causes of these accidents? Which one was in the boost phase and which one in the re-entry phase?
- 2-b) What does the word SUPARCO stand for? If you are appointed chairman of SUPARCO, what major changes you would like to bring about in the Pakistan Space Policy and why?

- 3-a) What are the criteria for choosing a gaussian surface? Write down the expression of Gauss' Law for gravitational fields.
- 3-b) Using Gauss' Law, compute the acceleration due to gravity as a function of distance from center of earth, $g(r)$, when $r < R_E$, $r > R_E$. Plot of graph of $g(r)$ vs. r . Show that both converge to the same value as $r \rightarrow R_E$.

- 4-a) If one digs a hole through the center-of-earth a sets a mass of 1 kg in oscillation, compute the expression of time period and numerical value using the data: $G = 6.6720 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$, $M_E = 5.975 \times 10^{24} \text{ kg}$, $R_E = 6.37115 \times 10^6 \text{ m}$ (G is universal gravitational constant, M_E is mass of earth, R_E is radius of earth).
- 4-b) What is the origin of magnetism of earth? Does the magnetic north pole coincide with the geographical north pole? If not, what effect does it have on the duration of day and night and temperature distribution in different parts of earth? Illustrate by drawing a diagram.

- 5-a) What are the different approaches taken for problem solving, in the classroom, in the laboratory, and in the industry? Describe, in detail, the steps involved for classroom problem solving.
- 5-b) A new model must satisfy 5 conditions. List all of them (e. g., EXPLAIN current observations, ...)

- 6-a) What is GMT? How are the different time zones created? If one crosses Dateline International from east traveling towards Japan, does one gain or lose a day?
- 6-b) A star is born on 1000-05-13 (year-month-day) and dies on 2009-05-15. Compute the age of this star in fractions.

- 7-a) By drawing a ray diagram explain how the solar and lunar eclipses are produced. What must be the condition in terms of the solid angles of the moon and the sun so that a total solar eclipse is produced?
- 7-b) Compare the salient features of Total Solar Eclipses of October 24, 1995 and August 11, 1999 as reported by the University of Karachi team. What precautions need to be taken while observing solar eclipse?