



B.Sc. Degree Programme (Level – 05)

Final Examination – Fundamentals of Geophysics

PHU 3159/PHE 5159

Date: 30th June 2009

Duration: 2 ½ Hours
From 13.30 hrs - 16.00hrs

Answer **FOUR (04)** questions. **SHORT ANSWERS ARE PREFERRED.** Answers should be illustrated with sketch maps and diagrams where appropriate. Each question is allocated 25 points, and the marking scheme is given in
G – Universal Gravitational Constant = $6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$, Mass of the Earth = $5.976 \times 10^{24} \text{ kg}$. Non programmable calculators are permitted.

- 1 (a) Sketch the internal structure of the Earth, showing and describing very briefly only its major subdivisions. (5 points)
- (b) Sketch a graph to show how the seismic body wave velocities S and P vary as a function of depth from Earth's surface. (10 points)
- (c) Explain the risk of Earthquakes on that part of the tectonic plate where Sri Lanka is located using your knowledge in plate tectonics. (5 points)
- (d) What is your explanation of the recently occurred earth tremors in the South, Uva and Eastern parts of Sri Lanka? (5 points)
2. (a) State Newton's Second Law. (5 points)
- (b) Using the Law of Universal Gravitation and Newton's Second Law, derive an expression for the acceleration of gravity. (5 points)
- (c) Calculate the approximate value for the acceleration of gravity at poles and at equator assuming that equator radius of 6378.75km and polar radius of 6356.75km. (10 points)
- (d) Which of the three most commonly applied corrections in gravity method is the least important and is often ignored? (5 points)
3. (a) Define: conductivity, resistivity, apparent resistivity (5 points)
- (b) Explain methods of vertical electrical sounding (VES) (5 points)
- (c) Describe how you would carry out a resistivity sounding test to determine the depth to the water table. Explain how the method of images can be used to derive model data as part of the interpretation process. (15 points)



4. (a) Define focus and epicenter of an earthquake. (5 points)
- (b) How do you determine the earthquake epicenter from seismic waves? (5 points)
- (c) Three seismometers (S_1 , S_2 , and S_3) are located at the longitudes and latitudes shown in the table below. They first measure P- and S-waves due to nearby nuclear explosion at times indicated in the table. The explosion occurs on the surface. Assume that local P-wave and S-wave velocities are $\alpha = 6.2 \text{ kms}^{-1}$ and $\beta = 4.1 \text{ kms}^{-1}$ respectively.
- (i) Calculate the distance from the nuclear explosion site to each of the seismometers. (10 points)
- (ii) Estimate the epicenter of the explosion (it lies within the region 40° - 43° N and 100° - 104° W). (5 points)

	S_1	S_2	S_3
Latitude	43° N	40° N	40° N
Longitude	100° W	100° W	104° W
First P-wave	13h 22m 57.7s	13hr 23m 4.7s	13hr 22m 40.1s
First S-wave	13h 23m 25.8s	13hr 23m 37.8s	13hr 23m 1.7s

5. (a) Describe two commonly used Global Coordinate Systems for navigation and positioning. (10 points)
- (b) Describe the technical theory behind the functioning of NAVSTAR GPS system. (5 points)
- (c) Discuss general and special features of NAVSTAR GPS constellation. (5 points)
- (d) Describe the technique known as Differential GPS (DGPS). (5 points)
6. (a) Discuss the use of ^{14}C in radiometric dating. (5 points)
- (b) How can natural radioactivity be used in geophysical exploration? (5 points)
- (c) Describe how you would carry out a geophysical survey to locate radioactive minerals concentrations in an area known for such occurrences. (15 points)

