BINDURA UNIVERSITY OF SCIENCE EDUCATION

Faculty of Science Education

Department of Physics and Engineering

HONOURS-Physics

HPH427

Geophysics

Duration: Three (3) Hours

INTSRUCTIONS

- *Answer ALL questions in Section A and any THREE questions from Section B. Section A carries 40 marks and each question of Section B carries 20 marks.*
- *Show ALL formulae and substitutions in ALL calculations.*
- *Leave your answers correct to 2 decimal places*

You may not start to read the questions printed on the subsequent pages until instructed to do so by the Invigilator.

SECTION A

(Answer **ALL** questions in this section.)

QUESTION 1 (40 MARKS)

a) Show that $f\ (t \pm \frac{x}{v})$ describes a propagating wave. Define all the physical quantities in the expression. (5)

b) A string fixed at one end only is vibrating in its third harmonic. The wave function is $y(x,t) = 0.02sin(3.13x)cos(512t)$, where y and x are in metres and t is in seconds.
   i) What is the wavelength of the wave? (4)
   ii) What is the length of the string. (2)
   iii) What is the speed of the transverse wave in the string? (4)

c) At 20° C, 33 meters of copper wire has a resistance of 0.639 ohms. What is the resistance of 165 meters? (3)

d) Briefly discuss the terms; Geysers, fumaroles, and hot springs. Your account should include how the geothermal features are formed? (9)

e) Define the term curie point (Curie Temperature) and briefly explain its relevance in Geophysics. (4)

f) With the aid of relevant well labelled diagrams, describe the three principal models of Isostasy. (9)

SECTION B

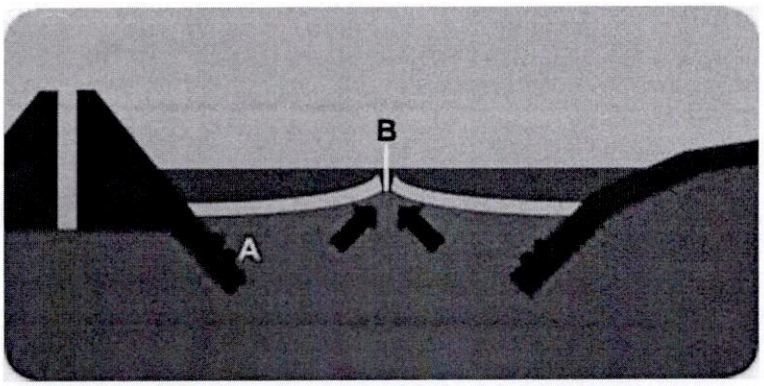
(Answer **ANY THREE** questions from this section)

QUESTION 2 (20 MARKS)

Plate tectonics is a scientific theory that explains how major landforms are created as a result of Earth's subterranean movements.

a) What are the three main types of plate boundaries. Identify one distinctive surface feature associated with each plate boundary. (6)

b) The diagram shows a cross section of a series of plate margins.



i. What are features A and B? (2)

ii. Explain why earthquakes occur at plate margins. (4)

Using examples that you have studied explain why more deaths occur in Less Economically Developed Countries (LEDCs) than More Economically Developed Countries (MEDCs) when earthquakes occur. (8)

QUESTION 3 (20 MARKS)

Describe briefly how geophysics is important in oil and gas exploration; discuss any five geophysical methods and comment on their application and importance in oil and gas exploration.

QUESTION 4 (20 MARKS)

A geophysical project typically comprises the following questions/steps:

a) What is the problem? (2)

b) What are the important physical property contrasts? (4)

c) What is the best survey method? (2)

d) What mode of data will be collected, spacing, frequency, airborne, ground, borehole etc.? (5)

e) What is the best way to process the data? (2)

f) What is the interpretation methodology? (2)

g) What are the conclusions? (Repeat all steps if necessary) (3)

With reference to a case history that you are familiar with, provide the answer to questions a) to g), bearing in mind that in some projects these questions are not always explicitly addressed (for example often specific types of surveys are acquired because the operator on the adjacent property acquired that type of survey).

QUESTION 5 (20 MARKS)

Briefly describe the five basic layers of the earth and the corresponding boundaries (discontinuities) between the layers with particular emphasis on various properties used to identify them.

THE END

Some useful constants

Constant	Value
Boltzmann constant	$1.38 \times 10^{-23}\ m^2 2\ kgs^{-2}K^{-1}$
Planck's constant	$6.63 \times 10^{-34} m^2 kg\ /\ s$
Speed of light in a vacuum	$3 \times 10^8 ms^{-1}$