



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

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## UNIVERSITY EXAMINATIONS 2023/2024

THIRD YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR  
OF SCIENCE IN PHYSICS

### SPH 3356: INTRODUCTION TO GEOPHYSICS

DATE: APRIL 2024

TIME: 2 HOURS

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INSTRUCTIONS: Answer Question ONE and any other TWO questions.

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#### QUESTION ONE (30 MARKS)

- Assuming the Earth is spherical calculate the centrifugal acceleration due to the Earth's rotation of an object at rest on the Earth's surface in Paris, assuming a latitude of  $48^{\circ}$  N. Express the result as a percentage of the gravitational attraction on the object (5 Marks)
- Differentiate between a subduction zone and a spreading centre (4 Marks)
- Describe the locations of epicenters of earth quakes as evidence of existence of tectonic plates (5 Marks)
- Given that the Sun's mass is  $1.989 \times 10^{30}$  kg and that its radius is 695,500 km, calculate the Roche limit for the Earth with respect to the Sun, Radius of the earth 6371Km and the mass is  $5.989 \times 10^{24}$  Kg (4 Marks)
- Using seismic velocities explain why it is presumed that between the upper mantle and the crust there is a semisolid later (4 Marks)
- Describe diamagnetic materials in terms of their magnetic susceptibility (4 Marks)



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ISO/IEC 27001:2013 CERTIFIED

- g) Explain the effect of hill of higher density than the surrounding rocks on the gravity and therefore the geoid (4 Marks)

**QUESTION TWO (20 MARKS)**

- a) Describe the physical properties of the Earth layers and how they are determined basing your argument on seismic wave propagation (12 Marks)
- b) Describe factors affecting the variation of gravity on the surface of the earth clearly explain their effect (8 Marks)

**QUESTION THREE (20 MARKS)**

- a) Derive the 3rd Kepler's law of planetary motion (6 Marks)
- b) The eccentricity  $e$  of the Moon's orbit is 0.0549 and the mean orbital radius  $r_L = (ab)^{1/2}$  is 384,100 km.
- Calculate the lengths of the principal axes  $a$  and  $b$  of the Moon's orbit (8 Marks)
  - How far is the centre of the Earth from the centre of the elliptical orbit? (2 Marks)
  - Calculate the distances of the Moon from the Earth at perigee and apogee (4 Marks)

**QUESTION FOUR (20 MARKS)**

- a) Explain the formation of mountain ridges (8 Marks)
- b) Describe the processes that take place at destructive margin identifying the features formed (10 Marks)
- c) What is isostatic equilibrium (2 Marks)

