



**DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY**

**UNIVERSITY EXAMINATION 2019/2020**

**EXAMINATION FOR MASTER OF SCIENCE IN GEOTHERMAL  
ENERGY TECHNOLOGY**

GET 3004: Geophysical Exploration

DATE: 21<sup>st</sup> January 2020

TIME: 9:00- 12noon

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*INSTRUCTIONS*

- 1) TIME ALLOCATED – 3 hours
  - 2) There are FIVE QUESTIONS in this paper
  - 3) Attempt only THREE questions
  - 4) Question 1 is compulsory and is worth 30 marks. The other two are 15 marks each
  - 5) This Paper will count for 60% of the total score of GET 3004. The other 40% will be earned from CATS and assignments
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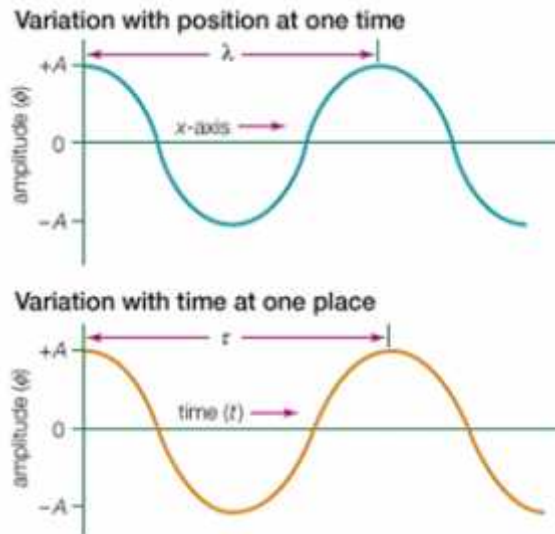
*Question 1 [30 marks] – This question is Compulsory*

- a) Geophysical Exploration is a powerful tool in investigating materials and structures in the subsurface. List any THREE geophysical methods and indicate how they can be used in such investigations. *[5 marks]*
- b) It is high recommended that during a geophysical exploration program, more than one geophysical technique be used. *[5 marks]*
- c) Sketch the kind of GRAVITY anomaly one is likely to observe when one travels from Nairobi to Kisumu. Why? *[5 marks]*
- d) What TWO Geophysical methods would you recommend to explore for Geothermal and WHY? *[5 marks]*
- e) Discuss any TWO challenges that one would expect to face when collecting HEAT FLOW measurements for geothermal energy exploration. *[5 marks]*
- f) Rocks are known to be poor conductors of electrical current. What controls the resistivity / conductivity of rocks? *[5 marks]*

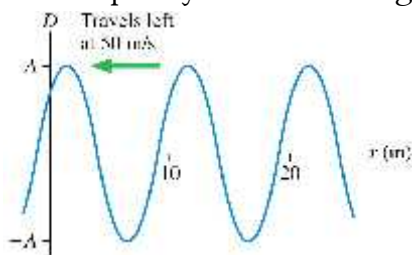
**Question 2 [15 marks] – This question is Optional**

a) Seismology, like all of the earth sciences, is a data-driven science. Discuss what type of data one would collect (e.g., is it on mass, time, speed, conduction, magnetisation etc?). How will this be used to infer the type of materials and structures in the subsurface? [10 marks]

b) State and define the terms represented by the symbols  $\lambda$  and  $T$  in the Figure. [5 marks]



What is the frequency of the following wave?



How are  $\lambda$  and  $T$  affected as a waves travels through the earth?

**Question 3 [15 marks] – This question is Optional**

a) What do you understand by an ANOMALY? Explain why a GEOTHERMIST would be interested in a resistivity anomaly during exploration. [5 marks]

b) Provide at least three possible reasons why earth's gravitational field changes within the rift valley, from north to south. [10 marks]

**Question 4 [15 marks] – This question is Optional**

a) Which geophysical method could you use for surveying ground water? Why and how would you carry out the survey? [10 marks]

b) Discuss why the East African Rift system has favourable conditions for geothermal energy. [5 marks]

*Question 5 [15 marks] – This question is Optional*

You have been given a task to investigate the ground properties for structural stability for construction of a storey building planned to be used as Geology Laboratory. Decide any ONE Geophysical Technique MOST appropriate to use, considering the following:

- a) What physical properties are relevant to measure (e.g., porosity, density, susceptibility, conductivity)? *[2 marks]*
- b) What spatial scales (area of measurement) are appropriate to the task? *[2 marks]*
- c) How you will collect the data and what type of data *[2 marks]*
- d) How you will process and analyse the data *[2 marks]*
- e) What prior information you will need to know *[2 marks]*
- g) And what conclusions you are likely to make for the assignment *[5 marks]*