



DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

UNIVERSITY EXAMINATION 2019/2020

**EXAMINATION FOR MASTER OF SCIENCE IN GEOTHERMAL
ENERGY TECHNOLOGY
AND MECHATRONIC ENGINEERING**

GET 3001: Introduction to Geothermal Systems

DATE: 20th January 2020

TIME: 2:00-5:00p.m.

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 3001. The other 40% will be earned from CATS and assignments
-

Question 1 [30 marks] – This question is Compulsory

It is commonly accepted that the standard of living increases with increasing energy consumption per capita.

- a) What are the Non-renewable Energy Resources? And what are they being used on?
[5 marks]
- b) What are the Alternative or Renewable Energy Sources? And why are they being referred to as *Renewable*?
[5 marks]
- c) East African Countries are advocating for Renewable Energy Technologies, can you advise on any shortcomings in their applications.
[5 marks]
- d) How does the temperature gradient change with depth in the Earth? Why does this gradient vary from place to place across the earth's surface?
[5 marks]
- e) What do you need to consider when assessing viability of a geothermal system? *[5 marks]*
- f) Offer an explanation as to why and how exploration for and use of geothermal energy has been successful in Kenya compared with her neighbours along the East African Rift System.
[5 marks]

Question 2 [15 marks] – This question is Optional

- a) How has utilisation of Geothermal Energy developed over the years in the world? Any challenges?
[5 marks]
- b) According to some research workers Global energy demand increased at its fastest rate since 2010. The research teams say that development of renewable energy is “essential” and a

“necessary step in securing our energy future.” What is your reaction to this assertion? That is, what’s your vision for a fossil fuel free future? [10 marks]

Question 3 [15 marks] – This question is Optional

A power plant is an assembly of systems or subsystems to generate electricity. The power plant itself must be technologically appropriate, economical and environmentally friendly to the society. [5 marks]

a) The type of geothermal power plant designed for a field depends on several factors. Name the three types of plants and the type of field (reservoir conditions/characteristics) they are constructed on. [5 marks]

b) Expanded power generation may lead to increased demand for steam and reduced extra steam capacity. How can this be addressed? [5 marks]

c) What 2 (two) major factors contribute towards making a geothermal field /geothermal reservoir suitable for generating electricity? [5 marks]

Question 4 [15 marks] – This question is Optional

a) Drilling is the only sure way of proving a geothermal resource. What situations can give rise to a well not being productive? [5 marks]

b) Discuss the application of geology, geophysics and geochemistry and for exploration of geothermal resources. Indicate any possible limitations [10 marks]

Question 5 [15 marks] – This question is Optional

a) Geothermal heat pumps can heat or cool homes. Explain how. [5 marks]

b) Outline the benefits that Kenya can get (or is getting) from direct applications of geothermal fluids. [5 marks]

b) If you became employed as an earth scientist tomorrow by the Geothermal Division of the Kenya Electricity Generating Company, what are your expected routine jobs? [5 marks]