

JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMIMATION FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT

3RD YEAR 2ND SEMESTER 2023/2024 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1304

COURSE TITLE: GEOTHERMAL ENERGY TECHNOLOGY

EXAM VENUE: STREAM: BSc. REN ENGY TEC & MGT

DATE: /04/2024 EXAM SESSION:

DURATION: 2 HOURS

Instructions

- 1. Answer question 1 (Compulsory) and ANY other two questions
- 2. Candidates are advised not to write on question paper
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.

QUESTION ONE (COMPULSORY) (30 Marks)

- a. Define the following terms:
 - i. Geothermal resource (1 Mark)
 - ii. Geothermal gradient (2 Marks)
 - b. Examine the basis of geological and geophysical data in estimating a geothermal resource. (4 Marks)
 - c. 60% of geothermal heat is derived from decay of long-lived radioactive isotopes. Using illustrations, explain this statement. (10 Marks)
 - d. List three types of geophysical surveys as used in geothermal energy exploration. (3 Marks)
 - e. The heat capacity of a geothermal source is a function of minerals that make up the rock, pore volume and whether it is fluid-filled. Examine this statement. (10 Marks).

QUESTION TWO (20 Marks)

- a. Examine the significance of understanding the chemistry of geothermal fluids. (5 Marks)
- b. Researchers have found that most reliable geothermometers for geothermal energy resource assessments are the silica, K–Mg, and Na–K–Ca geothermometers. Examine this statement. (5 Marks)
- c. Using illustrations, examine drilling for geothermal heat pump and direct-use applications. (10 Marks)

QUESTION THREE (20 Marks)

- a. Using illustrations, examine drilling for geothermal fluids for power generation. (10 Marks)
- b. Examine the uniqueness of geothermal power production compared to other power production methods. (5 Marks)
- c. State three types of geochemical surveys as used in geothermal energy exploration. (3 Marks)
- d. Examine the significance of geothermal resource assessment. (2 Marks)

QUESTION FOUR (20 Marks)

- a. Examine the flexibility and consistency of geothermal power generation. (5 Marks)
- b. Using neat pressure-entropy diagrams, examine the following.
 - i. Dry steam resources (5 Marks)
 - ii. Hydrothermal system (3 Marks)

- iii. Flashing (3 Marks)
- iv. Dual-flash systems (4 Marks)

QUESTION FIVE (20 Marks)

- a. Examine the types of geothermal systems as studied in geothermal energy technology.
 (10 Marks)
- b. Examine the economics of geothermal power in Kenya. (5 Marks)
- c. Examine environmental considerations while using geothermal resources in Kenya. (5 Marks)