



DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

GEOHERMAL TRAINING AND RESEARCH INSTITUTE

UNIVERSITY EXAMINATIONS 2021-2022

END OF SEMESTER EXAMINATIONS

FOR THE DEGREE IN MASTER OF SCIENCE IN GEOHERMAL ENERGY TECHNOLOGY

GET 3008 – RESERVOIR ENGINEERING

DATE:

TIME: 3 HOURS

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 3008 The other 40% will be earned from CATS and assignments

Question 1 [30 marks] – This question is Compulsory

- (a) Explain how permeable zones in reservoirs are identified in practice during well logging tests. *[5 marks]*.
- (b) Temperature can be used to classify geothermal reservoirs. Identify different types of reservoirs based on temperature. *[5 marks]*.
- (c) Figure 1 shows several temperature profiles from a heating well. Analyse and discuss this profile. Why do the profiles indicate increase in temperatures when logged over TIME? Explain/interpret the sharp rise in temperature around depth 800m. *[5 marks]*

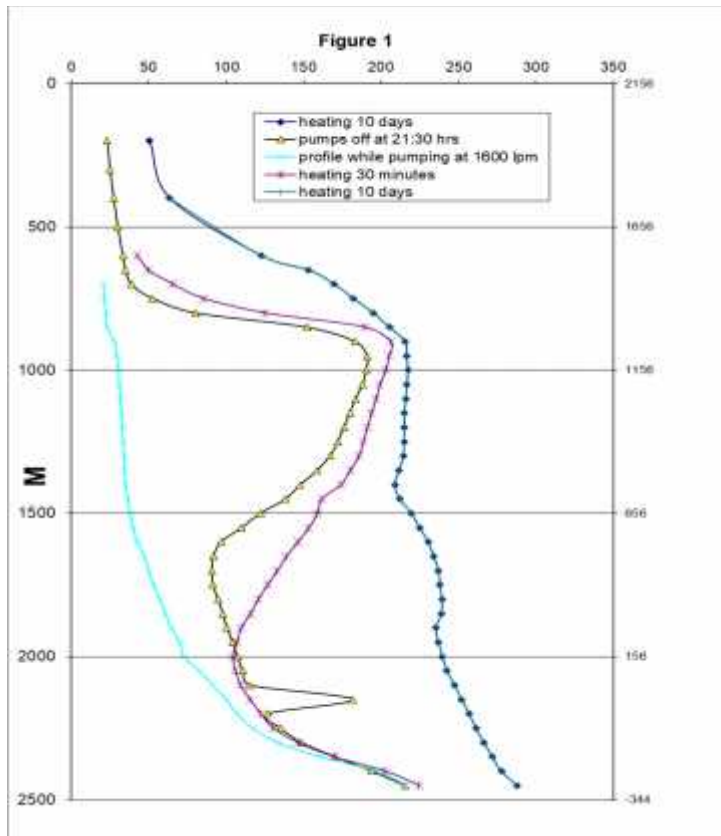


Figure 1: A well heating up

- (d) Part of a reservoir engineer's work is to conduct various well tests and field tests to evaluate different well and reservoir parameters. List and discuss any TWO types of field and well tests conducted by reservoir engineers. [5 marks]
- (e) Discuss how the two tests you have presented in (d) are conducted, how they are used to infer conditions in the reservoir and relevance of these parameters in reservoir assessment. [5 marks]
- (f) Values of temperature and pressure measured in a geothermal field are critical for proof of commercial viability. Explain why this statement is true. [5 marks]

Question 2 [15 marks] – This question is Optional

- (a) Tracer return rates, both in time (speed) and volumes recovered are important results in tracer tests. Analyse their implications. [10 marks]
- (b) Write short notes describing TWO roles or activities for a reservoir engineer during exploitation of a geothermal reservoir. [5 marks]

Question 3 [15 marks] – This question is Optional

- (a) Figure 2 is a Temperature log during warm-up period from a geothermal well. There is no flow from the well.

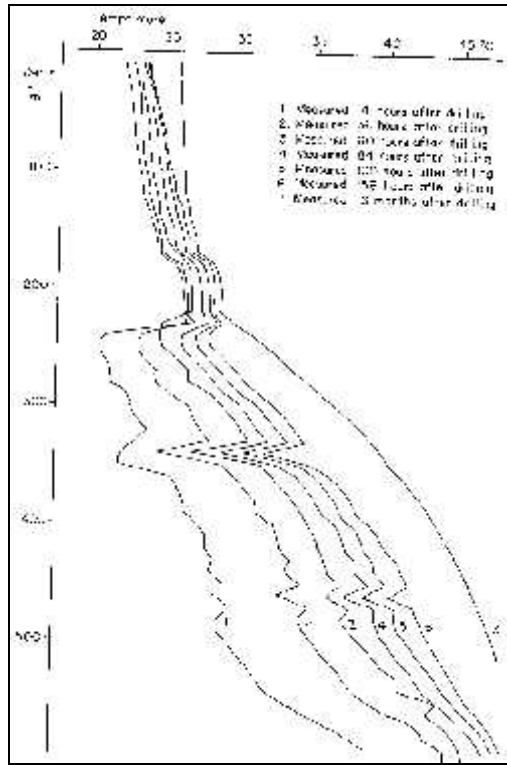


Figure 2

Identify 2 main probable feed/loss zones and explain your choice. [5 marks]

b) Figure 3 shows the production history of Chingshui geothermal field, Taiwan. It shows the field deliverability of geothermal fluids and the power output at Chingshui from 1981 to 1993. There was no re-injection of spent geothermal fluids. Offer possible explanations for the observed trends from 1981 to 1993. [5 marks]

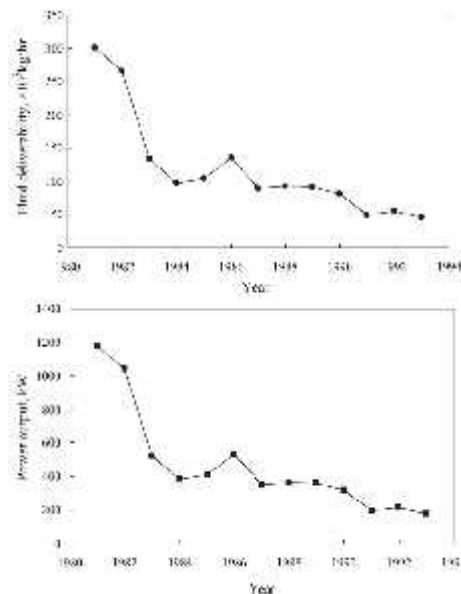


Figure 3

c) Write brief notes on what activities can be included in an integrated reservoir management. [5 marks]

Question 4 [15 marks] – This question is Optional

- (a) Reinjection is analogous to production test except that the fluid is injected into the well. Why is reinjection a necessary activity for a reservoir and production. [5 marks]
- (b) Write short notes on FIVE aspects which make a geothermal reservoir commercially viable for development. [5 marks]
- (c) Tracer return rates, both in time (speed) and volumes recovered are important results in tracer tests. Explain their implications. [5 marks]

Question 5 [15 marks] – This question is Optional

- (a) The line source or Thies equation given below is the basis for interpretation of well test.

$$P - P_0 = -\frac{Qv}{4\pi kh} \left(2.303 \log \left(\frac{4kt}{\phi\mu cr^2} \right) - 0.57772 \right)$$

Identify and name all variables in the equation. Explain how this equation is used in practice. [5 marks]

- (b) Darcy's equation is the main foundation upon which all reservoir transport equations are based Write any form of Darcy's equation for single phase fluid flow in only one direction. Identify and explain all terms that appear in your equation. [5 marks]
- (c) The James equation given below is used for computation of flow rates in tests using James method.

$$\frac{QH_t^{1.102}}{P_{lip}^{0.96}} = 1680$$

Identify and explain all terms that appear in the equation. [5 marks]