DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

GEOTHERMAL ENERGY TRAINING AND RESEARCH INSTITUTE
MSc IN GEOTHERMAL ENERGY TECHNOLOGY
END OF SEMESTER EXAMINATIONS
January – April 2020

GET 3007: Drilling Engineering

DATE: TIME: 3 HOURS

Question 1 [30 marks] – This question is Compulsory

a) Figure 1.1 represents the structure of a rig. Name and state the functions of parts 9, 14 and 25. *[5 marks]*

Figure 1.1

b) During drilling, a number of parameters are monitored. State any FOUR and give the reason for such a measurement. *[5 marks]*

c) Why is a Christmas Tree placed on the well head? How ?does it function *[5 marks]*

d) What are the advantages of carrying out *directional* drilling? What are the setbacks? *[5 marks]*

e) Figure 1.2 has discharge test data from a completion activity on well OW-915A in the Olkaria Domes.

Figure 1.2

Comment on the trend of *water flow* over time and relate this to *enthalpy changes* over the same period. Is the correlation or none-correlation expected? Why? How? *[5 marks]*

f) Geothermal wells have had to be abandoned or drilled to depths shallower than those planned due to technical challenges/considerations, **other than Finance**. State and explain 3 factors /criteria (excluding finances) that can determine the limits of the total depth of the well drilled.

Question 2 [15 marks] – This question is Optional

a)   State and explain 2 situations during drilling that a drilling engineer dreads most and why. *[5 marks]*

b)   Discuss the factors that can lead to a drill pipe becoming stuck during drilling. *[5 marks]*

c)   A rig must hoist a load of 300,000 lbf. The draw-works can provide an input power to the block and tackle system as high as 500 hp. Eight lines are strung between the crown block and travelling block.
   (i)   Explain why the maximum hook horsepower available is less than 500 hp (actual figure is 420.5 hp). *[3 marks]*

   (ii) Given that the maximum hoisting speed is 46.3 feet/minute. Determine how long it would take to pull a 90-ft stand. *[2 marks]*

Question 3 [15 marks] – This question is Optional

The total weight of 9,000 ft of 9 5/8-inch casing for a deep well is determined to be 500,000 lbs. 10 lines run between the crown and the travelling blocks. Neglecting friction and buoyancy effects and assuming that the total weight will be distributed equally between the 10 lines:

a)   Calculate the Tension (in lbf) on each line *[5 marks]*
b)   Calculate the maximum load on the derrick (in lbf). Remember to consider the tensions on the other 2 lines, i.e., the "fast" and "dead" lines. *[5 marks]*.

Refer to Figure 3.1 to assist you in the conceptualisation of the problem

Figure 3.1

c)   Indicate how the total mast load is different from the load being lifted and offer a possible explanation. *[5 marks]*

Question 4 [15 marks] – This question is Optional

a) State and explain THREE main functions of the casing string in any well. *[5 marks]*

b) Give and explain THREE reasons why cementing is done in a well-bore. *[5 marks]*

c) (i) Discuss how the amount of cement required for a drilling job is established. *[2 marks]*.
(ii) With the aid of a sketch, explain how the actual cementing job is done. *[3 marks]*.

Question 5 [15 marks] – This question is Optional

a)   What is *well-control*? What causes loss of well-control? *[5 marks]*

b) It is essential that while tripping, the hole is kept full of drilling fluid in order to avoid kicks and blowouts. An ordinary drill string is circular, 93 ft long and 5" Outside Diameter. The density of steel in air is 65.45 bbl/gallon. How much fill-up (in bbl) is required after pulling 5 stands? Get more relevant information from Table 1.6. Hint: From Table 1.6, actual weight in air is 20.60 lb/ft. Determine the total weight first. 1 bbl = 42 gallons. *[10 marks]*