INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: BACHELOR OF PETROLEUM ENGINEERING

YEAR/SEM: YEAR 2/SEMESTER 2

COURSE CODE: PTE2252

NAME: WELL LOGGING

DATE: 2025-04-17

TIME: 9:00AM-12:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A 1. This section comprises 4 questions, each for 20 marks 2. Answer any THREE questions for full marks 3. The marks for every question is indicated

Question 1:

(a) What is well logging? *[2.5 marks]*
(b) Give a brief explanation on how LWD is used in;
i. Optimizing drilling operations *[2.5 marks]*
ii. Geosteering *[2.5 marks]*
iii. Reservoir evaluation *[2.5 marks]*
(c) Discuss in depth the different applications of well logging in the oil and gas industry *[10 marks]*

Question 2:

(a) With the aid of diagrams, describe in sufficient details each of the following zones as resulted from drilling fluid invasion: *[each 4 marks]*
i. flushed zone, *[4 marks]*
ii. invaded zone and *[4 marks]*
iii. non-invaded zone *[4 marks]*

(b) Outline all the limitations of the following logs
i. Spectral density *[4 marks]*
ii. Sonic density *[4 marks]*

Question 3:

(a) Discuss the two components of electrochemical component of SP log [8 marks]
(b) What is the difference between â??Static Spontaneous Potentialâ?• and â??Pseudostatic Spontaneous Potentialâ?•? [6 marks]
(c) Outline any four well-known limitations of LWD [4 marks]
(d) Provide only two reasons why many geologists and companies prefer geophysical logging over geological logging. [2 marks]

Question 4:

(a) Suppose that the density log reads 2.49 gm/cc at a certain depth. Calculate the porosity for each of the following formation assuming that the fluid formation is fresh water with density equals to 1 gm/cc. *[10 marks]*
i. Gypsum with density 2.32 gm/cc *[3 marks]*
ii. Dolomite with density 2.85 gm/cc *[3.5 marks]*
iii. Anhydrite with density 2.96 gm/cc *[3.5 marks]*
(b) The following data are for an offshore exploration well,
- Bottom Hole Temperature (BHT) = 125Â°C
- Total Depth= 4572 m
- Mean Annual Surface Temperature = 70Â°F

Find the temperature gradient of the formation at 4572 m [1ft=0.305 m, Â°C=32+Â°F]

[10 marks]

Section B Instructions - This section comprises 4 questions, each for 20 marks - Answer any THREE questions for full marks for full marks - The marks for every question is indicated

Question 1:

(a) Outline the applications of SP log in oil and gas industry [10 marks]
(b) Describe the key differences between wireline logging and logging while drilling (LWD) [10 marks]

Question 2:

(a) Mention and describe two advantages of carrying out spectral gamma ray logs over total gamma ray logs.

[6 marks]

(b) What is porosity? Distinguish primary porosity from secondary porosity as applied in sedimentary rocks.

[5 marks]

(c) List any three factors that may affect porosity and permeability of sedimentary rocks

[9 marks]

Question 3:

(a) Explain how the presence of gas in the formation affects the velocity of seismic waves through the formation. *[6 marks]*

(b) Explain how hydrocarbon saturation is related to water saturation in a particular reservoir. *[5 marks]*

(c) The resistivity of a water-bearing sand was found to be 0.8 Ohm-m. If the porosity of the formation is 0.31 and for this formation the relationship between the formation factor, is given as $F = 0.81/Pi^2$, Calculate the resistivity of the formation water. *[9 marks]*

Question 4:

1. (a) Shed lights on the lateral tools and induction tools of array induction *[10 marks]*
   (b) Discuss the applications and limitations of resistivity logs *[10 marks]*