



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA
SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: PE 272
COURSE NAME: DRILLING ENGINEERING I
CLASS: PE II **TIME:** 3 HOURS

Name: _____ Index _____ Number: _____

ANSWER ANY FOUR QUESTIONS

QUESTION 1

- a. What are the advantages and disadvantages of oil based mud as opposed to water based mud. State two each.

[4 marks]

- b. After two consecutive insert bit runs on an offset well, the drilling engineer decided that it would be better to run a mud motor and a PDC bit to improve performance on the next well. The information in table 1 was derived from bit records and other sources on the wells. On a cost per foot basis, did the engineer make a good decision? **[8 marks]**

	Inserts	PDC & Motor
Number of bits	2	1
Cost Per bit	\$10 000	\$50 000
Cost of Rig	\$1 250/hour	1250/hour
Cost of Motor	0	\$300/hour
Rotating Hours	180	135
Non-rotating Hours	8	10
Total Trip Time	21 hours	12 hours
Footage	4 500 ft	4 500 ft
Average ROP	25 ft/hr	33.33 ft/hr

- c. List and briefly discuss the *three* major considerations when selecting/designing a drilling fluid for a particular well.

[9 marks]

- d. An 8 ½” hole is drilled to 8 000 ft using mud with a density of 12 ppg. If the formation pore pressure at this depth was 4 700 psi what would be the mud pressure overbalance, above the pore pressure.

[4 marks]

QUESTION 2

a. State the principal function of the following casing strings:

[8 marks]

- i. Conductor
- ii. Surface
- iii. Intermediate
- iv. Production casing

b. Give two advantages of running a liner, as opposed to a full string of casing.

[5 mark]

c. State two reasons for selecting the right thickening time for a cement operation.

[4 marks]

d. Give two (2) reasons why bit must be evaluated.

[4 marks]

e. State the purpose of accelerator and retarder in oil well cementing operation and give an example each.

[4 marks]

QUESTION 3

a. State three types of fishing tools and their uses.

[6 marks]

b. Give a detailed classification of bit types.

[4

marks]

c. Give three reasons for casing off formation.

[3

marks]

d. Enumerate three important functions of a cement sheath between casing and borehole.

[3 marks]

e. Identify the following items and explain their uses

[9 marks]



QUESTION 4

- a. Draw a rheogram (plot of shear stress versus shear rate) of the following types of viscous fluid in the same composite plot: *Newtonian; Bingham Plastic fluid; and Power law fluid*. **In addition** to the pertinent parameters (type of fluid, index factors), indicate the following on the plots. True viscosity, plastic viscosity and yield points. **[6 marks]**
- b. Write the equation representing each of the rheological fluid model in “a”. **[6 marks]**
- c. The total system pressure losses in a well’s circulating system is the sum of all the pressure losses in each segment of the well system and is reflected in the pump circulating pressure. Write a simple equation to describe this relationship. **[5 marks]**
- d. An oil based mud is being circulated in a well at a pump rate of 400 gal/min, with a surface pump pressure of 3 000 psi. The density of the mud is 12 lbm/gal. If the bit was dressed with two each 15/32-inch nozzles and one each 16/32-inch nozzle, calculate the total sacrificial pressure loss in the well’s circulating system. **[8 marks]**

QUESTION 5

Discuss briefly the following terms with appropriate diagrams:

- | | |
|---------------------------------|------------------|
| i. Loss circulation | [5 marks] |
| ii. Overbalanced drilling | [5 marks] |
| iii. Differential Pipe sticking | [5 marks] |
| iv. Bottom hole balling | [5 marks] |
| v. Squeeze Cementing | [5 marks] |

Course Examiners: Dr E. Broni-Bediako/Dr R. Amarin