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**Presidency University**

**Bengaluru**

**SCHOOL OF ENGINEERING**

**END TERM Examinations, Summer Term 2024**

**Semester**: Summer Term

**Course Code**: PET2001

**Course Name**: Drilling Fluid and Cements

**Program**: B.Tech. (Petroleum)

**Date**: 05-08-2024

**Time**: 01:00 PM – 04:00 PM

**Max Marks**: 100

**Weightage**: 50%

**Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Do not write any matter on the question paper other than roll number.*

**Part A [Memory Recall Questions]**

**Answer any four Questions. Each question carries five marks. (5Qx 4M= 20M)**

1. Define thickening time and density of cement slurry. Give two examples of density reducing agent and density increasing agents for cement slurry. (C.O.No.5) [Knowledge]

2. Identify any two advantage and disadvantage of mud cake. (C.O.No.1) [Knowledge]

3. State any two reasons for mud contamination in the wellbore along with the counter measures.

(C.O.No.4) [Knowledge]

4. Mention the role of mud cleaner in mud conditioning system. Why it is used for weighted mud?

(C.O.No.4) [Knowledge] 5. Tabulated the component of basic cements along with the chemical formula, trade name and amount. (C.O.No.5) [Knowledge]

6. State the role of mud thinner and thickener. Give two example of each. (C.O.No.2) [Knowledge]

7. Define cement accelerator and retarders. Give two example of each. (C.O.No.5) [Knowledge]

**Part B [Thought Provoking Questions]**

**Answer any four Questions. Each question carries ten marks. (4Qx10M=40M)**

8. Design a mud conditioning system layout specifically for non-weighted mud, ensuring each component is optimized for its unique function? Explain the role of each piece of equipment in this system. (C.O.No.4) [Comprehension]

9. Summarize the role of any five casing accessories in oil well cementing job.

(C.O.No.5) [Comprehension]

10. Explain the procedure for Single stage cementing job. (C.O.No.5) [Comprehension]

11. Elaborate the various rheological models using for Non-Newtonian Drilling fluid.

(C.O.No.2) [Comprehension]

12. Differentiate the following:

a. Newtonian and Non-Newtonian Drilling fluid

b. Desander and Desilter

c. Top Wiper plug and Bottom Wiper Plug

d. Tier-1 and Tier-2 HPHT wells

e. Overbalance and Underbalance well (C.O.No.2) [Comprehension]

13. Classify Oil well cement in a tabulated form and mention the depth ranges and special characteristic (if any) for each cement type. (C.O.No.5) [Comprehension]

**Part C [Problem Solving Questions]**

**Answer any two Questions. Each question carries twenty marks. (1Qx20M=20M)**

14. Solve the following:

a. Determine the quantity of barite required to change the density of mud from 12.53 ppg to 16.7 ppg. Calculate the increase in pit volume due to the addition of such a quantity of barite for an initial mud volume of 63 bbl.

b. It is required to reduce mud weight from 25.1 ppg to 22.6 ppg in order to combat a lost circulation problem. Calculate the volumes of water and oil required to bring about this reduction. Also, if oil is used, what is the percentage of oil in mud if the initial volume of mud is 629 bbl. The density of oil is 6.87 ppg. (C.O.No.2) [Application]

15. The following data are given.

Casing dimensions: OD 20 in, ID 18.73 in, 133 lbm/ft

Hole size: Hole size: 26 in; Casing setting depth: 350 ft; Mud weight: 65 pcf

Cement properties:

Cement API Class G with 4% bentonite

Slurry weight: 106 pcf; slurry yield: 1.5 ft3/sack

Water requirement: 7.6 gal/sack

Pumping rate: through

Drillpipe: 100 gal/min

Casing: 300 gal/min

Drill Pipe dimension: OD/ID 5 in/4.276 in, 19.5 lb/ft

Allow 15 min for the release of plugs and assume casing to be cemented to surface.

(Note: Cement data are obtained from cementing companies' handbooks.)

(a) Calculate required quantities of cement and bentonite for a conventional cementing job. A shoe

Track of 80 ft (24 m) is to be used. Also allow 100% excess cement in the open hole. (Nate: A shoe track is the distance between the casing shoe and the float or landing collar.)

(b) Calculate volume of mixing water.

(c) Calculate total time for the job, assuming that the mixing rate is 10 sacks/min.

(C.O.No.5) [Application]

16. A class G cement with 30% silica flour and 44% water is planned to be used in cementing deep section in an exploration well. If the cement silo can hold 80% of the neat class G cement, determine the aerated density of the cement inside the silo and the cement slurry density? Bulk density of class G cement is 94 lbs/ft3 and silica flour is 70 lbs/ft3.

***Or***

Cement slurry is designed to be prepared using class G cement, Bentonite and fresh water. If the mud weight of the cement slurry is 14.77 ppg and water percentage is 60%, what will be the Bentonite mass percentage based on the cement mass? [Density of Bentonite=22.02 ppg]

(C.O.No.5) [Application]