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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 04/ 01/ 2025 **Time:** 01:00pm – 04:00pm |

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| **School:** School of Engineering | **Program:** B.Tech in Petroleum | |
| **Course Code :** PET2001 | **Course Name :** Drilling Fluids and Cements | |
| **Semester**: III | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **0** | **24** | **6** | **24** | **46** |

**Instructions:**

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

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | Draw the graph representing Bingham Plastic model Graph and write relevant equations. | **2 Marks** | **L1** | **CO2** |
| **2** | Fill up the blanks:  a. Dynamic Pressure= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_+\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  b. The mixing operation involves the pouring of mud solids or chemicals through a \_\_\_\_\_\_\_\_\_\_\_\_\_connected to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, | **2 Marks** | **L1** | **CO2** |
| **3** | State how pH plays an important role in drilling fluid. | **2 Marks** | **L1** | **CO3** |
| **4** | List out the gases can be used for API Filtration loss test and also mention the reason for using these gases. | **2 Marks** | **L1** | **CO3** |
| **5** | Find TRUE or FALSE:  a. More the PV, higher the ROP  b. BENEX is a mud thinner  c. Gypsum or Anhydrite bearing formations can be drilled with Ca-Based mud  d. A mud without mud thinner is called native mud. | **2 Marks** | **L1** | **CO3** |
| **6** | Mention any two reason for Drilling mud contamination. | **2 Marks** | **L1** | **CO4** |
| **7** | Match the following: | **2 Marks** | **L1** | **CO4** |
| **8** | Explain the requirement of Cementing job in oil well drilling operation in two points. | **2 Marks** | **L1** | **CO5** |
| **9** | Mention any two cements which can be used in HPHT condition and High Sulfate bearing formation. | **2 Marks** | **L1** | **CO5** |
| **10** | State the requirement for removal of mud cake prior to a cementing job. Identify the equipment used to remove the mud cake. | **2 Marks** | **L1** | **CO5** |

**Part B**

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| **Answer the Questions Total 80 Marks.** | | | | | |
| **11.** | **a.** | Solve:   1. It is required to prepare 600 bbls of drilling fluid that have mud weight of 15.4 ppg using hematite with a specific gravity of 5.1. How many barrels of water and tons of hematite are needed to prepare the complete mud? 2. A surface section of 17.5" in a well is planned to be drilled using 5.5" drill pipes. The drilling fluid has mud weight of 9.4 ppg, plastic viscosity of 42 cp, and yield point of 17 lbf/100 ft2. If the planned pumping rate is 900 gpm, calculate the annular velocity, effective annular viscosity of the mud using Bingham Plastic and Power Law models.   [1gal=0.133681 cf] | **20 Marks** | **L3** | **CO2** |
| **or** | | | | | |
| **12.** | **a.** | A new section in a well is planned to be drilled using 10.4 ppg mud. There is 500 bbls of 9.5 ppg mud in the mud tanks. The mud engineer also prepared 700 bbls of 10.4 ppg and stored it in another mud tank. The new mud volume to be prepared for a special purpose which is 1500 bbls. Calculate the following: a) if the mud engineer mixed all the mud that are available in the mud tanks, what should be the mud weight of the new mud, and b) calculate the amount of Barite to be added to the mud in the tanks to prepare 1500 bbls of 10.4 ppg mud. Barite specific gravity is 4.3 [1bbl=42 gal]. | **20 Marks** | **L3** | **CO2** |
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| **13.** | **a.** | Case Study: Optimization of Drilling Mud Circulatory System for a Deepwater Exploration Well  Background:  In a deepwater exploration well located in the Gulf of Mexico, a drilling team faced challenges related to the efficiency of the mud circulatory system. The well had a depth of 20,000 ft, with complex geological formations and high-pressure zones that required precise control of the drilling mud properties. The existing mud circulatory system, including the mud pumps, shale shakers, and mud pits, was unable to maintain optimal drilling fluid properties, leading to issues with cuttings removal, wellbore stability, and pressure control.  Problem Statement:  The primary issues encountered in the circulatory system included poor cuttings removal, high fluid loss to formation, and inconsistent mud properties, which led to increased drilling time and costs. The mud system's inability to maintain stable rheological properties in the presence of variable formation pressures further complicated the situation.  Based on the above problem statement find a solution to obatain the following objective:   1. To optimize the mud circulatory system to: 2. Improve the removal of cuttings and control of wellbore pressure. 3. Ensure consistent mud properties for better wellbore stability. 4. Minimize fluid loss to formations and improve the overall efficiency of the drilling operation. | **20 Marks** | **L2** | **CO4** |
| **or** | | | | | |
| **14.** | **a.** | Explain the drilling mud circulatory system in detail with the help of a well-labeled diagram. Discuss the key components of the system. Highlight the functions of the system in transporting cuttings to the surface, maintaining wellbore stability, controlling formation pressures, and cooling the drill bit. Additionally, describe how the drilling fluid is processed and recycled in the system to ensure its effective reuse during the drilling operation. | **20 Marks** | **L2** | **CO4** |

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| **15.** | **a.** | Problem Statement:  To balance 100 sacks of Class G (Yield=1.2 cf/sack) neat cement in an 8⅜ in open hole using a 3½ in OD / 3.068 i ID tubing weighing 8.9 lb/ft, ith the hole depth at 7500 ft. Additionally, 15 bbl of water is used as a preflush ahead of the cement slurry (1 barrels = 5.615 cubic feet)  Required Calculations:   1. Total Slurry Volume, Annular Volume, and Tubing Volume 2. Height of the Balanced Plug 3. Volume of Water to be Used as a Spacer Behind the Cement 4. Volume of Mud Chase (Displacement Volume) 5. Number of Pump Strokes Required to Displace Cement to Just Below the Drillpipe Shoe, assuming a pump capacity of 0.15 bbl per stroke 6. Volume of Cement and Number of Sacks Required if the Height of the Plug is 500 ft | **20 Marks** | **L3** | **CO5** |
| **Or** | | | | | |
| **16.** | **a.** | With the help of the given data and schematic in Figure, calculate the following: i) Sack of cement of class G and H, and ii) Volume of mix water.  ***Given data:***  Hole depth : 13,900 ft  Shoe track : 80 ft  Hole size : 8.5 inch  Casing dimensions, OD/ID : 7 inch/6.184  Mix water required for Class G : 5 gallon/sack  Slurry yield of Class G : 1.15 ft3/sack  Mix water required for Class H : 5.49 gallon/sack  Slurry yield of Class H : 1.22 ft3/sack | **20 Marks** | **L3** | **CO5** |

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| **17.** | **a.** | Explain the essential properties of cement used in well cementing and discuss the functions of various cementing accessories that ensure effective placement and zonal isolation. | **20 Marks** | **L2** | **CO5** |
| **Or** | | | | | |
| **18.** | **a.** | Describe in detail the sequential steps involved in the single-stage cementing method, including the preparation, execution, and post-cementing processes, highlighting the specific roles of equipment and materials used at each stage. | **20 Marks** | **L2** | **CO5** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***