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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **Ph. D Course Work End Term Examinations – JAN-FEB 2025** |
| **Date:** 04 – 02- 2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** Ph. D  |
| **Course Code:** PET801 | **Course Name:** Advanced Drilling Fluid |
| **Semester**:  | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **10** | **30** | **20** | **40** | **-** |

**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 10 marks. 6Q x 10M=60Marks** |
| **1** | Discuss the disposal and recycling methods for drilling fluids, focusing on the environmental implications and challenges these processes pose. | **10 Marks** | **L2** | **CO3** |
| **2** | Categorize the nanoparticles used in drilling fluids, emphasizing their advantages and limitations. | **10 Marks** | **L2** | **CO2** |
| **3** | Describe synthetic-based drilling muds (SBMs), outlining their composition, benefits over other drilling fluids, and potential environmental and operational issues. | **10 Marks** | **L1** | **CO1** |
| **4** | Explain the safety protocols and emergency response measures in drilling fluid operations, stressing their importance in accident prevention and emergency handling. | **10 Marks** | **L3** | **CO3** |
| **5** | Explore real-time drilling fluid monitoring systems, detailing their components, advantages, and the challenges they face in modern drilling operations. | **10 Marks** | **L1** | **CO4** |
| **6** | Examine common challenges such as loss circulation and differential sticking in drilling operations, and discuss methods to troubleshoot and resolve these issues. | **10 Marks** | **L3** | **CO4** |

**Part B**

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| **Answer the Questions. Each question carries 20 marks 2Q x 20 = 40 Marks** |
| **7.** |  | In a drilling operation requiring High-Temperature High-Pressure (HTHP) drilling fluids, the parameters to be determined for a well at 15,000 ft depth with a formation pressure of 12,000 psi include the density of the HTHP drilling fluid to maintain wellbore stability, the hydrostatic pressure exerted by the drilling fluid at this depth, and the effect of temperature on the fluid density. Given that the pressure gradient is 0.052 psi/ft per lb/gal of fluid density, the fluid density required for the specified depth must be calculated. Additionally, with a surface temperature of 70°F and a final downhole temperature of 300°F, the fluid density decreases by 0.05 lb/gal for every 100°F temperature increase. The given data includes a base fluid density of 12.0 lb/gal at the surface, and these factors must be used to assess the changes in fluid density and hydrostatic pressure at the target depth. | **20 Marks** | **L4** | **CO2** |
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| **8.** |  | During a drilling operation in a vertical well, significant fluid loss and differential sticking issues are observed with the following recorded data: the total depth (TD) of the well is 10,000 ft, the wellbore diameter is 12.25 inches, the drill pipe outer diameter (OD) is 5 inches, and the inner diameter (ID) is 4.276 inches. The mud properties include a mud density of 12 lb/gal, a plastic viscosity (PV) of 30 cP, a yield point (YP) of 25 lb/100 ft², and a mud loss rate of 40 barrels/hour. The formation and sticking data show a differential pressure across the wellbore of 800 psi, a contact area of the pipe with the wellbore of 250 ft², and a coefficient of friction (μ) of 0.3. Loss circulation material (LCM) with a density of 20 lb/ft³ is applied, and the required LCM volume to mitigate fluid loss is 150 barrels. The tasks include estimating the total volume of fluid lost over 4 hours, determining the total weight of LCM needed to seal the loss zone, measuring the force due to differential sticking on the drill pipe, suggesting a mud weight increase to reduce differential pressure to 500 psi, assuming a linear increase in mud density with pressure, and calculating the total cost of fluid lost during the 4-hour period, assuming a cost of $100 per barrel for drilling fluid. | **20 Marks** | **L4** | **CO2** |

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