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Bengaluru

Mid Term Examinations - October 2026

Date: 07/10/2026 **Time:** 02:00 PM - 03:30 PM

Course Code: PET2103 **Course Name:** Drilling Fluids and Cements

Semester: Third Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2	CO3
Marks	22	46	22

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	Describe the primary purpose of using Non-Damaging Drilling Fluid while drilling a productive zone.	2	CO1	BT1
2	Label the chemical reaction for the transformation of feldspar to Kaolinite using acidic water.	2	CO2	BT1
3	List the clay minerals based on 1:1, 2:1 and 2:2 type silicate structure: Montmorillonite, Nacrite, Chlorites, Saponite, Halloysite	2	CO2	BT1
4	Define Zeta potential to different electrostatic double layers.	2	CO2	BT1
5	State Kinematic Viscosity and its field unit.	2	CO3	BT1

PARTB: Answer Any 1 Following Questions. 20 M

Q.N.	Questions	M	CO	BT
06.A	A vertical well is being drilled with an 8.5-in hole and a 5-in drill pipe. The drilling fluid is circulated at a flow rate of 500 gal/min. The mud density is 10 ppg, and its effective viscosity is 50 cp. The drilled cuttings have an average diameter of 0.30 in and a density of 21 ppg. Estimate: (a) The annular velocity of the drilling fluid, ft/min. (b) The slip velocity of the cuttings, ft/min. (c) The net lift velocity of the cuttings. (d) The percentage of annular velocity available for lifting the cuttings.	10	CO1	BT2
06.B	1. Explain the origin and occurrence of clay minerals. **(5 marks)** 2. Describe the structure of 2:2-type silicate clay. **(5 marks)**	10	CO2	BT2

PTO (Please Turn Over)

07.A	1. 500 bbl of 12 ppg mud is in the pit. You mix it with 15 ppg mud. Estimate the volume of 15 ppg mud needed to raise the 12 ppg mud to 13 ppg. **(3 marks)** 2. List two examples each of mud thinners and LCM used as additives in drilling fluid. **(2 marks)** 3. A well is drilled with 12 ppg mud at a depth of 10,000 ft TVD. The annular pressure loss while circulating is 260 psi. The pore pressure at this depth is 11.2 ppg and the fracture gradient is 13.0 ppg. Compute: a. The ECD. b. The margin (ppg) between the ECD and the fracture gradient. c. The maximum allowable annular pressure loss before fracturing. d. The static overbalance over pore pressure (psi) when the pumps are off. **(5 marks)**	10	CO1	BT2
07.B	1. Differentiate between crystalline swelling and osmotic swelling. **(4 marks)** 2. Predict the importance of cation exchange capacity in clay behaviour. **(4 marks)** 3. Arrange in ascending order of valence ion preference of elements on the clay surface: Ba^{2+}, Na^{+}, Cs^{+} , Sr^{2+}, H^{+}, Ca^{2+}, K^{+}, Li^{+}, Rb^{+} **(2 marks)**	10	CO2	BT2

PARTC: Answer Any 1 Following Questions. 20 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
08.A	1. Describe the structure of 1:1 and 2:1 silicate clays. **(6 marks)** 2. Describe the Tyndall effect in solution, colloid and suspension. **(4 marks)**	10	CO2	BT2
08.B	1. Explain the Bingham Plastic model. Predict what the intercept and the slope represent physically. **(3 marks)** 2. Two muds have the same $\theta_{300} = 30$: • Mud A: $\theta_{600} = 55$ • Mud B: $\theta_{600} = 42$. Interpret the PV, YP and AV of each. Identify which mud is better at carrying cuttings, and which indicates more solids, with reasons. **(4 marks)** 3. Illustrate how gel strength is measured. Compare the effect of low, flat gels with high, progressive gels in the field. **(3 marks)**	10	CO3	BT3
09.A	1. Differentiate between cohesive force and adhesive force. Relate both forces to the concept of wettability. **(6 marks)** 2. In a water-wet reservoir rock, the interfacial tension between oil and water is 30 dynes/cm, and the contact angle measured through the water phase is 30°. If the pore throat radius is 10 μm, estimate the capillary pressure (in kPa). **(4 marks)**	10	CO2	BT2
09.B	1. Drilling mud must do two opposite jobs: flow easily while pumping and build structure when pumping stops. Demonstrate how PV, YP, AV and gel strength describe this behaviour. **(5 marks)** 2. State why the apparent viscosity of mud is not constant, unlike that of water. **(2 marks)** 3. A mud gives $\theta_{600} = 40$ and $\theta_{300} = 26$. Calculate PV, YP and AV. **(3 marks)**	10	CO3	BT3