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**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

**End Semester Examination, December, 2017**



**Program Name: B.TECH/GSE, GIE**

**Semester – III**

**Course Name : DRILLING HYDRAULICS**

**Max. Marks : 100**

**Course Code : PTEG 212**

**Duration : 3 Hrs**

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**SECTION A:** Answer All the Questions.

**(5\*4M=20 Marks)**

- 1) Describe the four components of Water-base muds in detail.
- 2) A Bingham Plastic fluid has a plastic viscosity of 50 cP and a yield point of 12 lb/100 sq ft. Assuming that the flow pattern is laminar, Compute the frictional pressure gradient resulting from (a) a flow rate of 50 gal/min through a drill string having a 3.826 inch ID and (b) a flow rate of 90 gal/min through a 3 inch annulus.?
- 3) The density of 600 bbl of 12 ppg mud must be increased to 14 ppg using API barite. One gallon of water per sack of barite will be added to maintain an acceptable mud consistency. The final volume is not limited. How much barite is required? Also mention total gallons of water required.
- 4) Classify and Explain
  - a) Different type of fluids.
  - b) Different types of flows.
- 5) Determine the starting volume, bbl, of 12.0 ppg ( $W_1$ ) mud required to achieve 100 bbl ( $V_F$ ) of 13.0 ppg ( $W_2$ ) mud with calcium carbonate.

**SECTION B:** Answer All the Questions.

**(4\*10M=40 Marks)**

- 6) Define Swab and Surge Pressure. Also determine both the surge and swab pressure for the data listed below:

Data: Mud weight = 15.0 ppg Plastic viscosity = 60 cP

Yield point = 20 lb/100 sq ft Hole diameter = 7-7/8 in.

Drill pipe OD = 4-1/2 in. Drill pipe length = 14,300 ft

Drill collar OD = 6-1/4 in. Drill collar length = 700 ft

Pipe running speed = 270 ft/min

(10M)

- 7)
  - a) Mention the tests performed by each of these equipment:
    - i) Mud balance
    - ii) Marsh funnel and Rotational viscometer
    - iii) High-pressure, high temperature filter press
    - iv) Sand screen

- v) Mud still (5M)
- b) An upper plate of  $20 \text{ cm}^2$  area is spaced 1 cm above a stationary plate. Compute the viscosity in centipoise of a fluid between the plates if a force of 100 dyne is required to move the upper plate at a constant velocity of  $10 \frac{\text{cm}}{\text{sec}}$ .  
(5M)
- 8) Using the data listed below, determine the annular velocity, cuttings slip velocity, and the cutting net rise velocity:  
Data: Mud weight = 11.0 ppg Plastic viscosity = 13 cP  
Yield point = 10 lb/100 sq. ft Diameter of particle = 0.25 in.  
Hole diameter = 12.25 in. Density of particle = 22.0 ppg  
Drill pipe OD = 5.0 in. Circulation rate = 520 gpm (10M)
- 9) Define rheological model. List out different rheological models and show the relation between shear rate and shear stress for different rheological models? (10M)

**SECTION C:**

(2\*20M=40 Marks)

**Instructions:** Answer All the Questions

10)

- a) Derive the flow rate equation for a laminar fluid flow through a drill string using Power Law Model. (10M)
- b) Calculate the ECD below the bottom joint of 4,000 ft of 10.75 in casing (having a 10 in ID) if the casing is being lowered at a rate of 1 ft/s in a 12 inch hole containing 9 ppg brine having a viscosity of 2 cP and Yield Point of 10 lb/100 ft. sq. Assume that the flow pattern is laminar.. (10M)

11)

- a) A drilling mud is pumped at the rate of 200 gal/min through a drill pipe of 4.5 inch internal diameter and 400 ft length. The fluid has a density of 9 ppg, a plastic viscosity of 15 cP and a yield point of 10 lb/100 ft<sup>2</sup>. Determine the type of flow and the magnitude of the pressure drop through the drill pipe? (10 M)
- b) Determine surge pressure for plugged pipe and open pipe, for the data given below

Data:

Well Depth = 12,000 ft.

Hole Size =  $7 \frac{7}{8}$  in.

Drill Pipe OD =  $4 \frac{1}{2}$  in.

Drill pipe ID = 3.82 in.

$$\text{Drill Collar} = 6\frac{1}{4} \text{ in. O.D.} * 2\frac{3}{4} \text{ in. I.D.}$$

Drill Collar Length = 620 ft.

Mud Weight = 12.0 ppg.

Viscometer Readings:  $\Theta_{600} = 120.$

$\Theta_{300} = 80.$

Average pipe running speed = 250 ft/min.

(10M)