

**Answer all questions****Question No 1 (18 marks)**

1. Mention only three advantages of oil base mud drilling fluids.
2. Numerate the test equipment needed to perform the diagnostics test for cements recommended by the API.
3. Define the following:
  - I. Cement extenders
  - II. Class G cement
  - III. Casing yield strength
4. Give the distinguish character of Newtonian and Non Newtonian type of fluid with example of each one.

**Question 2 (18 marks)**

1. Calculate the static mud density required to prevent flow from a permeable stratum at 12300 ft if the pore pressure of the formation fluid is 8400 psig.
2. A 12 lbm/gal mud is being circulated at 400 gal /min. The 5 in drill pipe has an internal diameter of 4.33 in., and the drill collars have an internal diameter of 2.5 in. The bit has a diameter of 9.875 in. Calculate the average velocity in the
  - A. Drill pipe
  - B. Drill collars
  - C. Annulus opposite drill pipe
3. Compute the body yield strength ( $F_{ten}$ ) and burst pressure ( $P_{bur}$ ) rating for 16 in. K55 casing with a nominal wall thickness of 0.495 in. and nominal weight per foot of 84 lb/ft.

**Question 3(12 marks)**

Compute the corrected collapse pressure rating for 20 in., K -55 casing for in service conditions where the axial tension will be 1,000,000 lbf. Also, compute the minimum external pressure required for failure if the internal pressure will be 1,000 psig.

The following values are given by API for K-55 casing:

Body tension rating = 2,125,500 lbf.

Non stressed collapse rating =1,490 psi

Burst rating=3,060 psi

Wall thickness = 0.635 in

Inside diameter = 18.730 in

Outside diameter = 20 in

Steel area = 38.631sq in

$$(\sigma_{yield})_e = (Y)$$

$$F_1 = 2.8762 + 0.10679 \times 10^{-5}(Y) + 0.21301 \times 10^{-10}(Y)^2 - 0.53132 \times 10^{-16}(Y)^3$$

$$F_2 = 0.026233 + 0.50609 \times 10^{-6}(Y)$$

$$F_4 = \frac{46.95 \times 10^6 \left[ \frac{3(F_2/F_1)}{2 + (F_2/F_1)} \right]^3}{(Y) \left[ \frac{3(F_2/F_1)}{2 + (F_2/F_1)} - (F_2/F_1) \right] \left[ 1 - \frac{3(F_2/F_1)}{2 + (F_2/F_1)} \right]^2}$$

$$F_5 = F_4(F_2/F_1)$$

#### Question 4 (18 marks)

1. Determine Pressure loss around drill collar, surge ,and swab pressure from the following data:

Pressure loss around drill pipe = 480.5 psi

$\theta_{300} = 85$

$\theta_{600} = 130$

Hole diameter ( $D_h$ ) = 9 inch

Drill collar ( $D_{dc}$ ) =6.25 inch

Drill collar length ( $L_{dc}$ ) = 800 ft

Current mud weight (MW) = 12.5 lb/gal

Drill collar movement velocity ( $V_{dc}$ ) =250 ft/min

Well true vertical depth (TVD) =9000 ft.

2. Determine Pressure drop across a bit ( $p_b$ ) according to the following:

Flow rate (Q) = 800 gpm

Mud weight (w) = 9 ppg

Total flow area (A) = 0.3728 in<sup>2</sup>

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