UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2018

Program: B.Tech APE UP / APE GAS — **Semester – 4th**
Subject (Course): Drilling Engineering and Well Completion — **Max. Marks: 100**
Course Code : PTEG211 — **Duration: 3 Hrs**
No. of page/s: 3

SECTION A (5 x 4 = 20 marks)

1. Explain the fundamental working behind the use of KCl polymer mud as a shale inhibitor.
2. What is an Induction Time? For which component of cement an artificial induction time becomes an outmost necessity and why? (1+1+2 = 4 marks)
3. A 10000 ft, 7 in casing is to be cemented in an 8.5 in hole. If the mud density is 13.4 ppg (1.6 kg/l), calculate the volume of water spacer required ahead of cement which causes a 300 psi (21 bar) reduction in hydrostatic pressure in the annulus.
4. Calculate the vertical height of the kick for a deviated well having 60 deg as hole angle if the pit gain volume is 14 bbls. Given the annular capacity is 0.0316 bbl/ft.
5. What phenomenon comes into play when cement is exposed to a temperature beyond 110°C? Mention the additive used to tackle this issue with the working principle behind it. (1+3=4 marks)

SECTION B (4x 10 = 40 marks)

6. Answer the following interrelated questions: (5 x 2 =10marks)

a. Discuss the problematic situation when we have a single Apex for an individual cone of a roller cone bit?

b. What mechanism can be incorporated to avoid this situation?

c. Discuss the role and effect of Journal angle while designing a bit; also, mention its optimum range for soft as well as hard formations.

d. Elaborate the Cone Offset profile and Journal Angle profile for Soft and Hard formation.

e. Discuss the kind of mechanism a PDC bit operates on and mention the reasons for its superiority over roller cones.

7. Calculate the coordinates (x,y &z) for point D with azimuth and DLS.

The table below gives data from a directional survey.

Survey Point	Measured Depth along the wellbore ft	Inclination Angle I, deg	Azimuth Angle A, deg
A	3,000	0	20
B	3,200	6	6
C	**3,600**	**14**	**20**
D	**4,000**	**24**	**80**

8. During drilling of an 8.5 in hole at 8000 ft, a complete loss of circulation was observed. Drilling was stopped and the mud level in the annulus was observed to fall rapidly. The well was filled with water of 62 pcf density until the annular level remained stationary. If the volume of water used was 65.7 bbl and mud density 75 pcf, determine the formation pressure and the new mud weight required to balance the formation pressure. Assume the intermediate casing to be 9i in, 40 # set at 6000 ft. DrilIpipe is Grade E, 5 in.
9. Determine the quantity (No. Of Sacks) of barite required to change the density of mud from 1.5 kg/l to 2 kg/l. Calculate the increase in pit volume due to the addition of barite for an initial volume of $10m^3$.
   What would you infer if the pit volume rise is $1m^3$ and also state the further modifications required.

SECTION C (2x 20 = 40 marks)

1. Primary Cementing of 7 inch Production Casing:
   Hole Depth = 13900 ft
   Hole Size = 8 ½ “
   Casing shoe = 13891 ft
   Mud Weight = 87 pcf
   Casing Dimensions = OD/ID = 7 in/6.184in; Grade C95 29#
   Cement Details:
   Cement Column should be 6562ft long as follows:
   From shoe to 656 ft use API Class G cement from 656 ft to 6562 ft use API Class H cement with 2 % Bentonite and 0.3 % HR-4
   A certain volume of cement was used to reduce the hydrostatic head by 300 psi.

Allow 15 mins for plug release
Shoe track: 80ft
Mix cement at 25 sacks/min and displace cement at 300 gpm.

	Class G Cement	Class H Cement
Slurry Weight	118 pcf	115 pcf
Slurry Volume	1.15 ft^3/sack	1.22 ft^2/sack
Mix water	5 gal/sack	5.49 gal/sack

Calculate: (5 x 4 = 20 marks)

a) Quantity of Cement of each class.
b) Volume of Mix Water
c) Total Time for the job
d) Pressure Differential prior to bumping the Plug.
e) Annular Velocity during Chase.

2. During Drilling of an 8.5inch hole at 10,000ft, a kick was encountered. The well was shut in and the pressure recorded on both drillpipe and annulus were:
DPSIP = 200psi
CSIP= 400psi

Other relevant data include:

Last casing = 9 5/8 inch, N80, 43.5 lbm/ft, ID = 8.755 inch
Casing Setting Depth= 8600ft
Drill Collars: 8inch / 3 inch , 500ft
Drill Pipe = standard D/P
Circulation pressure (normal) = 2000psi at 60 strokes per minute
Present mud weigh = 75 pcf
Pumping speed = 3 bbls/min @ 30 spm at circulation pressure of 500psi.
Casing Burst pressure = 5930 psi

Draw the variation in standpipe pressure w.r.t Strokes and Time considering Wait and Weight method used for killing the well. Calculate the corresponding pressures for strokes at 1000, 1500, 2000, 3200, 4000 and 6000.

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