FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF PETROLEUM ENGINEERING

Course: Drilling Engineering Technology III
Course code: PET 501
Unit: 3 units
Time: 3 hours [2-5pm]

Session: 2019/2020
Semester: Harmattan
Date: 08/02/2020

Instructions: Answer any 5 questions.

Q1a. List the classifications of casing connections. [4marks]
b. State the casing design process using flow chart. [5marks]
c. List the procedures to be applied during casing sizes and depths selections [5marks]
d. Enumerate the procedures to be applied when running liners. [3marks]
e. Define the critical conditions to be considered during burst and collapse design. [3marks]

Q2. A driller when drilling 8 $1/2$ inch hole of mud weight 10.6 ppg had a kick at 8200ft, shut in drill pipe pressure is 420 psi.
a. What will be the first thing the driller should do? [2marks]
b. Calculate the kick mud weight [3marks]
c. What are the primary signs that show that kick has occurred?[3marks]
d. Will kick occur at 8200ft if the formation pressure is 4800psi, why?[4marks]
e. Using the flow, show the operational procedure following the detection of a kick.[5marks]
f. List the precautions to be taken before tripping out of hole immediately after drilling.[3marks]

Q3. a. Explain any three applications of directional drilling. [6 marks]
b. Make a sketch of a directional well profile to illustrate the positions of the following terms associated with directional wells: Kickoff depth, Total vertical depth, inclination, horizontal displacement and measured depth. [5 marks]
c. What are the three reference systems commonly used in directional drilling? [3 marks]
d. Convert the following quadrant bearings into azimuth: (i) N 66.5°W (ii) S 88-3/4°W (iii) N 71 1/2°E [6 marks]

Q4a. Give any four reasons why accurate knowledge of the course of a wellbore is necessary. [4 marks]
b. List any three tools which can be used to change the direction in which a bit will drill. [3 marks]
c. In survey calculations, three pieces of information are known while four are unknown at the end of a successful survey. what are the known and unknown parameters? [4.5 marks]
d. While drilling a deviated well, the measured depth, inclination and azimuth of the well were measured at station 1 (see survey data below). Determine the position of the wellbore at the second survey point (station 2) using the radius of curvature method [8.5 marks]

Station	MD (ft.)	INC (deg.)	AZI (deg.)	Northing (ft.)	Easting (ft.)	TVD (ft.)
1	1000	10	S40°E	-110.26	86.32	943.13
2	1062	11.5	S37°E			

Q5. a. Give three (3) reasons hydraulic systems are analyzed while drilling oil and gas wells. [3 marks]
b. What are the consequences of improperly designed hyraulic system [3 marks]
c. Explain the term "particle slip velocity", Vs and state factors that affact it [4 marks]
d. Pump out recorded during mud circulation was 239.4 gal/min. 5% cuttings concentration was observed in the annulus of $8\frac{1}{2}$ inche hole size with drill pipe outside diameter of $4\frac{1}{2}$ inches. Determine cuttings transport efficiency and maximum rate of penetration using a slip velocity of 0.10812 fps. Assuming the same pump circulated a 9.8 ppg mud at 4.8 bbl'min in the same hole and drill pipe size, what would be the maximum rate of penetration? [10 marks]

Q6. a. Intermediate casing would be cemented with 11.4 lb/gal mud at 7,000 ft, 15.4 lb/gal Class H cement between 7,000 ft and 9,000 ft while 16.6 lb/gal Class H cement is between 9,000 ft and 12,000 ft. Would the static hydrostatic pressure fracture the formation at 12,000 ft, assuming the fracture pressure is 14.2 lb/gal. [4 marks]
b. What could poor cleaning of cuttings beneath the bit cause? [1 marks]
c What are the practical applications of pressure drop across the bit? [3 marks]
d. A 10.4 ppg mud was being pumped at 9 bbl/min at 10,000 ft well depth. The pressure drop across the bit was 2000 psi. Determine the bit nozzle diameter, Hydraulic Horsepower and Jet Impact Force. [12 marks]