Name:	
Enrolment No:	

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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Safety in Drilling (HSFS 7008)   Semester: II
Program: M.Tech HSE & M.Tech HSE Spl in DM
Time: 03 hrs.   Max. Marks: 100

Instructions: Please read all the questions before giving answers

SECTION A			
S. No.		**Marks**	**CO**
Q 1	What are the advantages and disadvantages of Open hole and closed hole well completion?	4	CO3
Q 2	Discuss the purpose of drilling mud.sa Why it is required to control solids in a Drilling fluid?	4	CO2
Q 3	Analyze and explain the importance of circulating system and drilling fluid in drilling operations.	4	CO2
Q 4	List out and explain all the relevant components of a drilling rig.	4	CO1
Q 5	Calculate the hydrostatic pressure in PSI. Given that Mud weight=12ppg,TVD=10000ft.	4	CO2
SECTION B			
Q 6	Calculate the Drill collar weight in a deviated well of inclination 60degrees.Take the safety factor for the bit to be 60% and it is given the planned mud weight to be 12ppg.Also explain the relation between stress and strain. OR Illustrate various types of Cementation processes in detail. What do you understand by Squeezing technique? What does high and low pressure squeezing means? Identify all the application of squeezing in cementation.	10	CO4,CO3
Q 7	Summarize different types of well control. What do you understand by SIDPP, SICP and SHUT IN Process? What are the different types of kill procedures?	10	CO2
Q 8	Given that a API,5inch S-135 ,Class New drill pipe having minimum yield strength of 135000psi.Calculate the Tensile capacity considering 80% well thickness?	10	CO2

OD = 5"
Normal ID = 4.276"
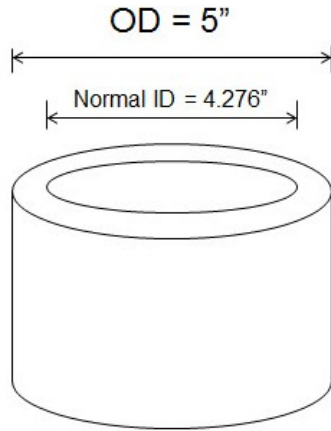
Q 9	Analyze the safety, health & environmental issues in Drilling. What do you mean by Fishing and blowout? Also discuss the operation of BOP in well control with diagram.	10	CO4

<div align="center">SECTION-C</div>

Q 10	Formulate the mass of API Barite and the initial volume of the drilling fluid. Given that approximately 1 gallon of water per 100lbm of API barite is usually sufficient to prevent an unacceptable increase in fluid viscosity Given V2=V1 +Vb+V,.where V1 is the initial volume V2 is the final volume ,Vb is the volume of API Barite to be added and Vw is the volume fresh water to be added. Calculate the mass of barite and the volume of fresh water to be added. OR A company ABC desired to increase the density of 850 bbl of 12-lbm/gal mud to 14-lbm/gal. one gallon of water will be added with each 100-lbm sack of API barite to prevent excessive thickening of the mud. A final mud volume of 850 bbl is desired. Evaluate the volume of old mud that should be discarded and the mass of API barite to be added. Reference Table:	20	CO3,CO2

Material	Specific gravity	Density	
		lbm/gal	lbm/bbl
attapulgite	2.89	24.1	1011
water	1	8.33	350
diesel	0.86	7.2	300
bentonite clay	2.6	21.7	910
sand	2.63	21.7	910
average drilled solids	2.6	21.7	910
API barite	4.2	35	1470
CaCl2	1.96	16.3	686
NaCl	2.16	18	756

| Q 11 | **CASE STUDY ON FATAL ACCIDENT IN DRILLING RIG WHILE WELL PRODUCTION TESTING**
 A fire incident took place at drilling rig during production testing. The fire led to serious burn injury to one person; two other persons also received minor burn injuries. All the three injured persons were immediately rushed to hospital for treatment. The person with ~70% burn injury passed away on the 5th day.
 Brief description:
 The well (where the incident occurred) was drilled to target depth, 5 ½" production casing was lowered to bottom and cemented. After hermetical testing, the well was handed over for production testing. The object interval was perforated and tubing string with BB shoe was lowered up to the top of perforation. Blow out Preventer stack was disconnected, removed and Xmas tree was installed. Well volume was displaced with water to activate the well. Since the Well was not self-flowing in spite of maximum permissible drawdown, Bottom Hole Study (gradient survey) was carried out for quantitative analysis of hydrocarbon inflow at the bottom of the hole. Based on the results of the gradient survey, it was decided to subdue the well and release the drilling rig for the next location. The well was to be subdued by displacing the hydrocarbon oil / gas, present in the well, by water with reverse circulation. Pumping of water through annulus was started and the return through tubing (gas and oil) was being taken in crude oil tanks placed near waste pit. The return line consisted of 2 7/8" tubing connecting X-mas tree to two crude oil tanks with a T manifold. This return line was not connected through mobile testing separator unit. After five minutes of the reverse circulation, fire broke out near the oil tanks and one person with completely burning coverall was seen near the accumulator unit. Two persons rushed to his rescue and received minor burn injury in this process. All the three were immediately shifted to hospital in the emergency vehicle of the rig. Simultaneously, mud pump was stopped, X-mas tree valve was closed and the fire was put under control with the portable diesel engine operated fire pump. The person with 70 – 80% burn injury passed away on the 5th day of the incident in the hospital. | 20 | CO5 |

Observations:

i. It is evident from the IADC report of the rig dated 8th March, 2013 that there was continuous feeble flow of gas during the observation period. Gradient survey also showed presence of gas in the upper portion of the well bore. Still mobile production separator was not used to separate and discharge the gas at a safe distance from the rig. Though production separator was available at the site at the time of this incident, as informed, the gas /oil were taken in the open roof crude oil tank.

ii. SOP (Safe Operating Procedures) for 'Killing or subduing of well' is available in the 'XYZ – SOP Work over operations – onshore' but it was found to be deficient. It does not mention steps for separation and discharge of associated gas at safe distance from the rig, during this operation, when gas is present (in present case there was feeble flow of gas continuously).

iii. Well killing job, requires continuous monitoring by testing team under a competent supervisor. It was informed that only one person (the deceased) from production side was present at the rig site during the well killing operation, instead of full testing team.

iv. It transpired from the discussions with the site personnel that the deceased production engineer was not having portable gas detector with him during this operation.

v. Accumulation of gas near the ground level is evident from the following: - The waste pit lining was found burnt starting from crude oil tank corner to 20 meters towards the rear of the drill site. - There was no indication of oil fire inside or outside the front crude oil tank. (Though both the tanks were receiving the well return fluid simultaneously).

vi. It was informed that the deceased was a non-smoker and nobody had ever seen him smoking.

vii. It was informed that there was no wind on the day of the incident and the weather was calm.

viii. The crude oil tanks were not earthed.

ix. There is no procedure in place to prohibit carrying cell phones in the operational area.

x. The deceased person was not wearing fire retardant overall

Infer the root causes and recommendation for the above mentioned accident case study?

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SECTION A

S. No.		Marks	CO
Q 1	What is the purpose of drilling mud? Why it is required to control solids in a Drilling fluid?	4	CO1
Q 2	What are the advantages and disadvantages of Open hole and closed hole well completion?	4	CO3
Q 3	Infer the importance of circulating system and drilling fluid in drilling operations?	4	CO2
Q 4	Calculate the hydrostatic pressure in PSI. Given that Mud weight=12ppg,TVD=12333ft.	4	CO2
Q 5	List out all the components of a drilling rig used in drilling operations.	4	CO1

SECTION B

Q 6	Explain the different types of well control. What do you understand by SIDPP and SICP? What is SHUT IN process? Explain in detail the different types of kill procedures. OR Discuss the safety, health & environmental issues in Drilling. What do you mean by Fishing and blowout? Discuss the operation of BOP in well control with diagram.	10	CO3
Q 7	Calculate the Drill collar weight in a deviated well of inclination 30 degrees.Take the safety factor for the bit to be 30% and it is also given the planned mud weight to be 15ppg.Also explain the relation between stress and strain?	10	CO3
Q 8	Illustrate the term "well Testing". How many types of well testing are there? Differentiate different types of Shut in procedures stepwise.	10	CO2
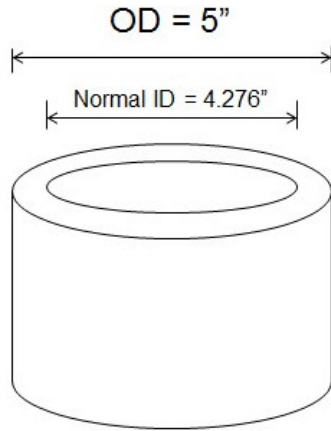
	OD = 5" Normal ID = 4.276"		
Q 9	Describe various types of Cementation processes in detail. What do you understand by Squeezing technique? What does high and low pressure squeezing means? Discuss all the application of squeezing in cementation.	**10**	**CO3**
	SECTION-C		

Q 10	Explain the following terms in brief:
	    i) Tool Joint
	    ii) WOB
	    iii) Buoyancy Factor
	    iv) Young's Modulus
	    v) Derrick
	    vi) Blowout
	    vii) SIDPP
	    viii) SICP
	    ix) ICP
	    x) FCP
	
	OR
	
	Formulate the mass of API Barite and the initial volume of the drilling fluid. Given that approximately 1 gallon of water per 100lbm of API barite is usually sufficient to prevent an unacceptable increase in fluid viscosity
	Given V2=V1 +Vb+V,.where V1 is the initial volume V2 is the final volume ,Vb is the volume of API Barite to be added and Vw is the volume fresh water to be added.
		20	**CO1,CO2,CO3**

Q 11	A company ABC desired to increase the density of 800 bbl of 12-lbm/gal mud to 14-lbm/gal. one gallon of water will be added with each 100-lbm sack of API barite to prevent excessive thickening of the mud. A final mud volume of 800 bbl is desired. Evaluate the volume of old mud that should be discarded and the mass of API barite to be added. Reference Table:	**20**	**CO4**

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