


Name:			
Enrolment No:			
UPES Supplementary Examination, December 2023			
Programme Name: B. Tech APE UP Course Name: Drilling Process Sys Design & Optimization Course Code: CHGS 3021P		Semester: V Time: 3 hrs Max. Marks: 100	
Instructions: ➤ All questions are compulsory. However, internal choice has been provided. You must attempt only one of the alternatives in all such questions.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	If a well encounters problems during drilling and due to this problem, the approved budget fails, which two decisions should be made?	04	CO1
Q 2	Optimizing weight on bit (WOB) is an essential part of drilling to ensure that the well deepens as drilling moves forward. Justify	04	CO2
Q 3	Define PDC bits and major components of bit design	04	CO1
Q 4	How to reduce dogleg severity in directional drilling? suggest the techniques and optimization methods	04	CO1
Q 5	Why to maintain hydrostatic pressure is greater than formation pressure? Justify	04	CO2
SECTION B (4Qx10M= 40 Marks)			
Q 6	a) Sketch the flow diagram of a “Mud Circulation System	5+5	CO2 + CO3

	b) Explain any two properties of a drilling fluid and illustrate their importance.		
Q 7	<p>Explain the types of drilling bits and comment on bit performance to optimize the drilling operation.</p> <p style="text-align: center;">OR</p> <p>Selection criteria of drilling bits and discuss the design process of PDC bit design.</p>	10	CO3
Q 8	Distinguish the rheology control material, lost circulation material and filtration material in drilling fluid	10	CO4
Q 9	<p>Explain design criteria for Annular and Ram type BOP and discuss in detail their types.</p> <p style="text-align: center;">OR</p> <p>List out the different deflection tools used in directional drilling? Explain whip stock tool types with their advantages and disadvantages with selection criteria</p>	10	CO4
SECTION-C (2Qx20M=40 Marks)			
Q 10	<p>a) The hoisting system of a rig derrick has a load of 350,000 lbf. The input power of the draw works for the rig can be a maximum of 530 hp. Eight drilling lines are strung between the crown block and traveling block. Consider there is some loss of power due to friction within the hoisting system. Compute:</p> <ol style="list-style-type: none"> (1) the static tension in the fast line when upward motion is impending, (2) the mechanical advantage of the block and tackle, (3) the maximum hook horsepower available, (4) the maximum hoisting speed, (5) if a 90 ft stand is required to be pulled, what should be the required time, (6) the actual derrick load, (7) the maximum equivalent derrick load, and (8) the derrick efficiency factor <p>b) While drilling, 250 hp was applied to rotate the drillstring and bit where 500 rpm was recorded from the rotary speed machine. In addition, 175 hp was applied to rotate 3,500 ft of drillpipe off 5 in OD with the same</p>	15+5	CO5

	speed as drillstring. Assume that $C_d = 0.000005$. Calculate the required torque for drilling string and the specific gravity of mud.								
Q 11	<p>a) Designing a Deviated Well. It has been decided to sidetrack a well from 1500 ft. The sidetrack will be a build and hold profile with the following specifications:</p> <table border="1" style="margin-left: 40px;"> <tr> <td>Target Depth</td> <td>: 10000 ft.</td> </tr> <tr> <td>Horizontal departure</td> <td>: 3500 ft.</td> </tr> <tr> <td>Build up Rate</td> <td>: 1.5° per 100 ft.</td> </tr> </table> <p>Calculate the following:</p> <p>a. the drift angle of the well.</p> <p>b. the TVD and horizontal deviation at the end of the buildup section.</p> <p>c. the total measured depth to the target.</p> <p>b) Calculate the liner size required for a double-acting duplex pump where rod diameter is 3.0 in, stroke length is 25 in stroke; pump speed is 75 strokes/min. In addition, the maximum available pump hydraulic horsepower is 1500 hp. For optimum hydraulics, the pump recommended delivery pressure is 3,500 psi. Assume the volumetric efficiency of pump is 98%.</p> <p style="text-align: center;">OR</p> <p>i. Derive the derrick load and derrick efficiency factor calculations with friction and without friction.</p> <p>ii. A 9 5/8-inch, 53.5 lb/ft casing string is set at a depth of 13,150 ft. Since this will be the heaviest casing string run, the maximum mast load must be calculated. Assuming that 10 lines run between the crown and the traveling blocks and neglecting buoyancy effects, calculate the maximum load.</p>	Target Depth	: 10000 ft.	Horizontal departure	: 3500 ft.	Build up Rate	: 1.5° per 100 ft.	10+10	CO6
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