

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Elements of Rig Component Design

Semester: 3rd

Programme: APE UP

Time: 03 hrs.

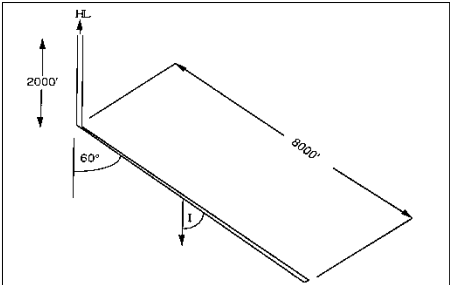
Max. Marks: 100

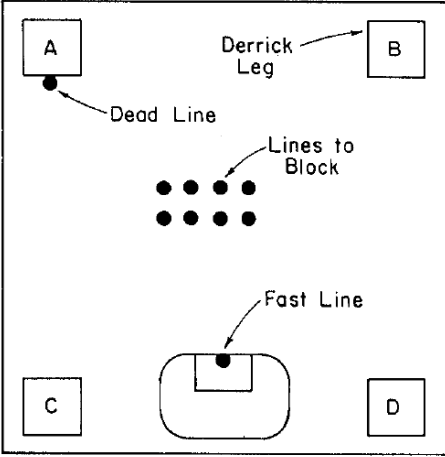
Instructions:

SECTION A

S. No.		Marks	CO
Q1	Elaborate the classifications of modern drilling rigs. State their differences and the common working principle of operation.	4	CO4
Q2	Describe Mechanical Collapse Pressure. Calculate the Collapse Pressure while drilling a 7000ft well having a mud density of 75pcf.	4	CO1
Q3	Calculate the efficiency factor of a hoisting system employing 8 string lines. Assume the values of K to be 0.9615.	4	CO5
Q4	Describe the importance of Yield Strength, Tension, MOP and S.F while designing a drill string	4	CO1
Q5	State the application of Torque and Drag while carrying out drill string design as well as operations.	4	CO2

SECTION B

Q6	Statement of question	10	CO1
	<p>A well with a measured depth of 10,000 is perfectly vertical to the kick-off point at 2,000 ft. A string of 7" OD csg. is in the hole; total length is 10,000 ft. The 8,000-ft segment is inclined at 60 deg. Buoyed weight of pipe = 30 lbs/ft. Coefficient of friction = 0.3</p>  <p>Evaluate the following:</p> <ul style="list-style-type: none">(a) Hook load when rotating off bottom(b) Hook load when RIH close to bottom(c) Hook load when POH close to bottom(d) Torque when rotating off bottom <p>[ignore effects of dogleg at 2000 ft.]</p>		
Q7	Determine the maximum permissible dog leg which will not result in fatigue damage	10	CO3

	<p>in the following case: Grade S: Drill Pipe 5" OD 4.276"ID, weight 19.5 lb/ft Depth 5500 ft Tension load is 180,414 lb at 5500 ft.</p>		
<p>Q8</p>	<p>An Exploration Rig has the following grades of Drill Pipe to be run in a 15,000 ft deep well:</p> <p>Grade E: 5/4.276 in; 19.5 lbm/ft; Yield Strength = 395600 lb Grade G: 5/4.276 in; 19.5 lbm/ft; Yield Strength = 553830 lb</p> <p>The maximum expected mud weight at 15,000 ft is 100 pcf. If the total length and weight of Drill Collars (DC) plus Heavy Walled Drilled Pipe (HWDP) is 984 ft and 157374 lb, respectively, calculate:</p> <p>a) The maximum length that can be used from each grade of drill pipe if an Margin of Overpull (MOP) of 50,000 lb is to be maintained for the lower grade. b) The MOP of the heavier grade</p>	<p>(7+3) =10</p>	<p>CO2</p>
<p>Q9</p>	<p>Calculate the load distribution on each legs of the derrick considering the below layout. Given that the weight of the Drill String, hook and the travelling block is 300,00lbf. Also calculate the Maximum Equivalent Derrick Load for the following layout. Weight of the travelling block is 20,000 lbs.</p>  <p style="text-align: center;">OR</p> <p>A rig must hoist a load of 300,000 lbs. The drawwork can provide an input power to the Block and Atckle system as high as 500 HP. Eight lines are strung between the Crown Block and Travelling Block. Calculate:</p> <ol style="list-style-type: none"> 1. The maximum hook horse power available. 2. The maximum hoisting speed. 3. The actual derrick load 4. The maximum equivalent derrick load. 5. The derrick efficiency factor. 	<p>10 marks</p> <p>(5x2)= 10</p>	<p>CO4</p>

SECTION-C

Solve the following case study in the given parts i.e Q10 and Q11

Consider yourself as a Service Provider and you have won a contract to design the Drill String and the Rig of a Client Company. Subsequently, the Client Company has provided with the following data with which they wish to drill and conduct a DST operation:

Hole size: 12 ¼ inch
 Last Bit Depth: 11,000 ft
 KOP = 3000 ft
 Compressive Strength of Rock = 50,000 lbs
 Inclination = 40 deg
 Both drill pipe grade of E-75 and X-95 are available in the inventory of the operator company.
 Drill Collars: 8 inch / 3 inch of 500 ft of 150 lb/ft
 Over-pull : 100000 lbs
 Mud Weight = 11.5 ppg
 DST Packer Depth = 10,700 ft
 Length of Slip = 16 inch ($\gamma=9.46$, friction coefficient: 0.8)
 Maximum Anticipated Surface Pressure = 5000 psi
 Include torque and drag considering a friction factor of 0.3.
 Design Factors:
 (1) Tension: 1.3 to 1.5
 (2) Collapse: 1
 (3) Burst: 1.1
 Hoisting rate = 50 ft/min
 Heating value of Diesel = 19000 BTU/lbm
 Output torque of Engine = 2000 lb-ft
 Efficiency of Block and tackle system (crown block and travelling block)= 0.841 for 10 lines.
 Efficiency of Engine = 40 percent.

CO6

Q10

Analyze the whole procedure for drill string design and recommend the grade that is to be used.

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Q11

Provide the Client company with the required HP rating for hoisting operation with operating RPM, Input power and feed rate of fuel (consumption rate). Also analyze a detail load evaluation of the rig and provide the Client Company with Derrick Efficiency

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OR

Analyse the torque and drag of the entire drill string with a BUR of 3deg/100ft.