Name: **Roll No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May-2022

Programme Name: B Tech (Applied Petroleum Engineering –Upstream)
Course Name: Drilling Engineering and Well Construction **Time:** 03 hrs
Course Code: PEAU 2008 **Semester:** IV **Max. Marks:** 100
Instructions:

- All questions are compulsory
- Assume appropriate missing data, if any.
- Filled kill sheet to be attached with answer sheet if you are attempting this question.
- However, internal choice has been provided. You have to attempt only one of the alternatives in all such questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q1	Define Duplex and triplex pumps?	**04**	**CO1**
Q2	The three basic forces which the casing experienced during drilling?	**04**	**CO1**
Q3	Optimizing weight on bit (WOB) is an essential part of drilling to ensure that the well deepens as drilling moves forward. Justify.	**04**	**CO3**
Q4	Distinguish between MWD & LWD.	**04**	**CO4**
Q5	Define KOP, inclination angle and azimuth angle?	**04**	**CO4**

SECTION B
(4Qx10M=40 Marks)

Q 6	List and describe the functions of each of the component parts of the hoisting system on a conventional land drilling rig?	**10**	**CO2**
Q 7	a) Explain in detail about different types of drilling fluids? b) Mention any 6 properties of a drilling fluid and explain their importance?	**5+5**	**CO3**
Q 8	It was decided to reduce the mud weight from 11.4 ppg while tripping in the well of 9,780 ft TVD. String was run to 5,700 ft and original mud was displaced by 10.8 ppg mud. a. What will be the bottom hole pressure now? b. When string was run down to bottom the entire well was displaced by	**5+5**	**CO4**

	10.6 ppg muds. Calculate the bottom hole pressure in static condition.		
Q 9	Differentiate between single stage cementing operation with multi-stage cementing operation. Briefly explain purpose of cement bond logs (CBL). **OR** Assam's Baghjan gas well blowout on June 9 ,2020 –Case Study Explain briefly – i. The path of tragedy :Background ii. What went wrong : investigation iii. The consequences : Ecology ,Economics, etc iv. Long term & short term effects on environment v. What lessons learnt for future: Key recommendations	**10**	**CO5**
SECTION-C **(2Qx20M=40 Marks)**			

Q 10	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: Target Depth : 10000 ft. Horizontal departure : 3500 ft. Build up Rate : 1.5° per 100 ft. Calculate the following: a. the drift angle of the well. b. the TVD and horizontal deviation at the end of the buildup section. c. the total measured depth to the target B) Discuss the advantages of Rotary steerable system over mud motor systems	**15+5**	**CO4**
Q 11	The 13 3/8" casing string of a well is to be cemented using class 'G'cement. Calculate the following for two stage cementing calculation: a) The required number of sacks of cement for a 1st stage of 700 ft. and a 2nd stage of 500 ft.(Allow 20% excess in open hole) b) The volume of mixwater required for each stage. c) The total hydrostatic pressure exerted at the bottom of each stage of cement (assume a 10 ppg mud is in the well when cementing) d) The displacement volume for each stage. 20" Casing shoe : 1500 ft 13 3/8" Casing 77 lb/ft : 0 - 1000 ft 13 3/8" Casing 77 lb/ft :1000 - 7000 ft. 17 1/2" open hole Depth : 7030 ft. Stage Collar Depth : 1500 ft. Shoetrack : 60 ft. **Cement stage 1** (7000-6300 ft.) Class 'G' Density :15.9 ppg Yield : 1.18 ft^3/sk Mixwater Requirements : 0.67 ft^3/sk **Cement stage 2** (1500-1000 ft.) Class 'G' + 8% bentonite Density : 13.3 ppg Yield : 1.89 ft^3/sk Mixwater Requirements : 1.37 ft^3/sk	**20**	

Q 11	**VOLUMETRIC CAPACITIES** **Drillpipe** 5" drillpipe : **Casing** 13 3/8" 72 lb/ft : 13 3/8" 77 lb/ft : **Open Hole** 26" Hole 17 1/2" Hole **Annular Spaces** 26" hole x 20" Casing: 17 1/2" hole x 13 3/8" Casing: 30" Casing x 20" Casing: 20" Casing x 13 3/8" Casing: **OR**	**bbls/ft** 0.01776 0.1480 0.1463 0.6566 0.2975 0.2681 0.1237 0.3730 0.1816	**ft³/ft** 0.0997 0.8314 0.8215 3.687 1.6703 1.5053 0.6946 2.0944 1.0194	
	Original mud weight Measured depth Kill rate pressure @ 50 spm **Drill string**: drill pipe 5.0 in. — 19.5 lb/ft capacity HWDP 5.0 in. 49.3 lb/ft capacity length **drill collars** 8.0 in. OD — 3.0 in. ID capacity length **Annulus:** hole size drill collar/open hole capacity drill pipe/open hole capacity drill pipe/casing capacity Mud pump (7 in. x 12 in. triplex @ 95% eff.) Leak-off test with 9,0 ppg mud Casing setting depth Shut-in drill pipe pressure Shut-in casing pressure Pit volume gain True vertical depth	= 9.8 ppg = 10,000 ft = 1000 psi = 0.01776 bbl/ft = 0.00883 bbl/ft = 250 ft = 0.0087 bbl/ft = 350 ft = 12 1/4 in. = 0.0836 bbl/ft = 0.1215 bbl/ft = 0.1303 bbl/ft = 0.136 bbl/stk = 1130 psi = 4000 ft = 450 psi = 550 psi = 40 bbl = 10,000 ft	**10x2 =20**	**CO5**
	Use the above data to answer the following questions :			

	(A) SURFACE TO BIT STROKES ----------stks (B) BIT TO SHOE STROKES ----------stks (C) BIT TO SURFACE VOLUME ----------bbl (D) KILL MUD WEIGHT ----------ppg (E) INITIAL CIRCULATING PRESSURE ----------psi (F) FINAL CIRCULATING PRESSURE ----------psi (G) MAASP WITH CURRENT MUD WEIGHT ----------psi (H) MAASP AFTER CIRCULATING KILL MUD ----------psi (I) TIME FOR COMPLETE ONE CIRCULATION ----------min (J) PRESSURE DROP PER 100 STROKES ----------psi			

Surface BOP (Vertical Well) Kill Sheet	API Field Unit

Formation Strength Data:

Surface Leak-off Pressure	(A)	psi
Mud Weight	(B)	ppg

Maximum Allowable Mud Weight

(B) + (A) / Shoe True Vertical Depth x 0.052

(C) ppg

Initial MAASP

{(C) –Current Mud Weight} x Shoe TVD x 0.052

= psi

Pump No.1 Displacement	Pump No.2 Displacement
bbls /stroke	bbls / stroke

Slow Pump Rate Data	Dynamic Pressure Loss (PL) Pump No. 1	Pump No. 2
Spm		
Spm		

Current Well Data :

Mud data:

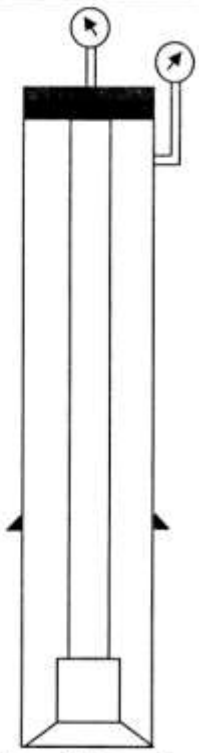
Mud Weight ppg

Casing Shoe Data:

Size	in.
M.D.	ft.
T.V.D.	ft.

Hole Data:

Size	in.
M.D.	ft.
T.V.D.	ft.



Pre-Volume Data:	Length Ft.		Capacity Bbls/ft.	Volume Bbls	Pump Strokes	Time minutes
Drill Pipe		x	=		Volume / Pump Displacement	Pump Strokes / Slow Pump Rate
Heavy Wall Drill Pipe		x	=			
Drill Collars		x	=			
Drill String Volume				(D) bbl	(E) stks	min

DC x Open Hole		x	=			
DP/HWDP x Open Hole		x	=			
Open Hole Volume				(F) bbl	stks	min

DP x Casing		x	=	(G) bbl	stks	min

Total Annulus Volume	(F +G) = (H) bbl	stks	min
Total Well System Volume	(D+H) = (I) bbl	stks	min

Kick Data					
SIDPP		psi	SICP	psi	Pit Gain	bbls

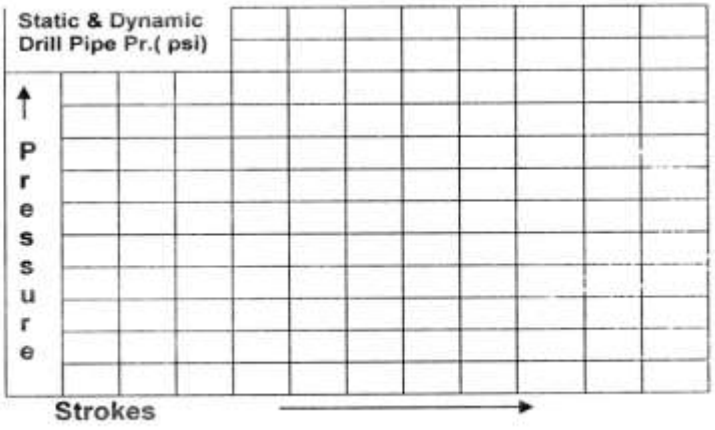
Kill Mud Weight **KMW**	Current Mud Weight + $\frac{\text{SIDPP}}{\text{TVD X 0.052}}$	= ppg

Initial Circulating Pressure **ICP**	Dynamic Pressure Loss + SIDPP	= psi

Final Circulating Pressure **FCP**	$\frac{\text{Kill Mud Weight}}{\text{Current Mud Weight}}$ x Dynamic Pressure Loss	= psi

(K) = ICP – FCP = = psi	$\frac{(K) \times 100}{(E)}$ = psi / 100 strokes

Strokes	Pressure



All The Best