Name: Enrolment No:	

UPES

End Semester Examination, December 2024

Programme Name : M.Tech HSE **Semester :** III

Course Name : Safety in Drilling **Time :** 03 hrs

Course Code : HSFS 8034 **Max. Marks:** 100

Nos. of page(s) : 07

Instructions: Assume suitable data wherever necessary. Answer should be *to the point and precise.*

SECTION A

(30 Marks)

Answer all question

S. N		Marks	CO
Q 1	A hoisting system raises an 1200 ft section of drill pipe in three stages: - First stage: Lifts 400 ft at 10 ft/min. - Second stage: Lifts 400 ft at 8 ft/min. - Third stage: Lifts 400 ft at 6 ft/min. How much time will it take to lift the entire 1200 ft section of drill pipe?	**5**	**CO1**
Q 2	Choose the best answer: **1. Which of the following is the most effective way to reduce the risk of a blowout during drilling operations?** A. Using a larger drilling bit B. Properly maintaining and testing blowout preventers (BOP) C. Drilling at faster speeds D. Using less drilling mud **2. What does the term "kick" refer to in the context of oil well drilling?** A. The process of sealing the well after completion B. The sudden influx of formation fluids into the wellbore C. The installation of drilling equipment D. The final stage of the drilling operation **3. Which of the following is the most important factor for maintaining well control during drilling operations?** A. Monitoring the weight of the drill string B. Regularly checking for equipment wear C. Maintaining mud density and proper circulation D. Using high-quality drilling mud additives **4. In case of a well blowout, which action should be taken first?** A. Activate the blowout preventer (BOP) B. Evacuate all personnel from the rig C. Inform the environmental agencies D. Attempt to stop the flow manually	**10x2 (20)**	**CO1**

	5. What is the purpose of an Environmental Impact Assessment (EIA) in oil well drilling? A. To evaluate the safety risks to the workers B. To determine the costs of the drilling project C. To assess the potential effects of the drilling operation on the environment D. To evaluate the efficiency of the drilling process **6. During drilling operations, if there is a risk of a fire or explosion, what is the primary safety equipment to have on hand?** A. Fire extinguisher and water source B. Personal protective equipment (PPE) C. Drilling mud and wellhead sealing equipment D. Flammable gas detector and fire suppression system **7. What is the purpose of well casing in drilling operations?** A. To stabilize the wellbore and prevent collapse B. To measure the depth of the well C. To increase the rate of fluid flow into the well D. To control the pressure inside the well **8. Which of the following is a major safety concern in offshore oil drilling operations?** A. Limited access to drilling tools B. Exposure to extreme temperatures C. Falling overboard and drowning D. Risk of oil spills and environmental contamination **9. What is the role of a Safety Officer on an oil drilling rig?** A. To ensure proper installation of the well casing B. To monitor the safety and health of all personnel on the rig C. To oversee the operation of the blowout preventer D. To manage the drilling fluids **10. What should be done in case of a toxic gas leak on the oil rig?** A. Evacuate the personnel and shut down all operations B. Increase ventilation to dilute the gas C. Continue with normal operations until the source of the leak is found D. Contact the emergency services without evacuating the rig		
Q 3	**"Nothing happens suddenly"** This statement encourages mindfulness and deeper analysis of the processes leading to any event, reminding us to stay attentive to the journey rather than just the outcome. Please express your opinion?	**5**	**CO4**
SECTION B **(15 Marks * 3 = 45 Marks)**			

Q 4	i.	A drilling rig's hoisting system requires a torque of 250 ft-lbs to lift the load. If the radius of the draw work drum is 2 ft, what is the force exerted on the drum? If frictional losses in the hoisting system cause a 12% decrease in the effective force, calculate the new force exerted on the drum when the required torque remains 250 ft-lbs.	**2+3**	**CO2**
	ii.	Why is early kick detection critical during drilling operations, and what are the key indicators used to identify a kick in the wellbore?	**3+3**	
	iii.	What are the key responsibilities of an HSE Engineer at a drilling rig site?	**4**	
Q 5	(a)	Draw a neat diagram of drilling rig showing main components. What roles do they play in the drilling process?	**5+4**	**CO2**
	(b)	A drilling mud is to be prepared by mixing 650 gallons of base oil with 450 gallons of water. If the density of the base oil is 8.5 lb/gal and the density of water is 8.34 lb/gal. calculate: i. The total volume of the drilling fluid mix. ii. The total weight of the drilling fluid mix. iii. The average density of the drilling fluid mix.	**2+2+2**	
Q6	On May 27, 2020, a blowout occurred at an oil well operated by Oil India Limited (OIL) in the Tinsukia district of Assam, India, which raised significant concerns regarding environmental safety, regulatory practices, and the broader impact on local communities. Considering this incident, please address the following questions:			
	i.	What were the key technical failures or lapses that contributed to the blowout at the Baghjan oil well?	**5**	**CO4**
	ii.	In what ways has the blowout affected the surrounding environment, including local ecosystems, water quality, and air pollution?	**5**	
	iii.	What improvements should be made in safety protocols and risk management strategies to prevent such incidents from occurring in the future?	**5**	
SECTION C **(25 Marks * 1 = 25 Marks)**				
Q 7	A.	What are the key codes and standards commonly used in the oil and gas industry to ensure Health, Safety, and Environmental (HSE) compliance.	**5**	**CO3**
	B.	**Use the following data and fill out the killsheet.** Original mud weight = 9.5 ppg. Measured Depth = 10,520 ft. Kill rate pressure @ 50 spm = 990 psi. Drill String: Drill pipe 5.0 in – 19.5 lb/ft capacity = 0.01776 bbl/ft. HWDP 5.0 in-49.3 lb/ft Capacity = 0.00883 bbl/ft. Length = 250 ft. Drill Collars 8.0 in OD – 3.0 in ID Capacity = 0.0087 bbl/ft. Length = 350 ft. Annulus:	**2x10=20**	

	Hole Size = 12 ¼ in. Drill Collar/Open hole capacity = 0.0836 bbl/ft. Drill Pipe/Open hole capacity = 0.1215 bbl/ft. Drill Pipe/Casing Capacity = 0.1303 bbl/ft. Mud pump = 0.136 bbl/stk. Leak off test with 9.0 ppg mud = 1130 psi. Casing setting depth = 4000 psi. Shut in drill pipe pressure = 440 psi. Shut in casing pressure = 540 psi. Pit volume gain = 35 bbl. True vertical depth = 9,900 ft. Also, fill the following data from filled kill sheet (i) Surface to Bit strokes ---------- stks. (ii) Bit to shoe strokes ---------- stks. (iii) Bit to surface volume ---------- bbl. (iv) Kill mud weight. ---------- ppg. (v) Initial Circulating Pressure ---------- psi. (vi) Final Circulating Pressure ---------- psi. (vii) MAASP with current mud weight ---------- psi. (viii) MAASP after circulating kill mud ---------- psi. (ix) Time for complete one circulation ---------- min. (x) Pressure drop per 100 strokes ---------- psi. **NOTE: Filled kill sheet must be attached with the answer script.**		

International Well Control Forum

Surface BOP Vertical Well Kill Sheet (API Field Units)

DATE : _____

SAP NO : _____

FORMATION STRENGTH DATA:

SURFACE LEAK -OFF PRESSURE FROM FORMATION STRENGTH TEST **(A)** psi

MUD WEIGHT AT TEST **(B)** ppg

MAXIMUM ALLOWABLE MUD WEIGHT =

(B) + $\frac{\textbf{(A)}}{\text{SHOE T.V. DEPTH x 0.052}}$ = **(C)** ppg

INITIAL MAASP =

(**(C)** - CURRENT MUD WEIGHT) x SHOE T.V. DEPTH x 0.052

= psi

PUMP NO. 1 DISPL.	PUMP NO. 2 DISPL.
bbls / stroke	bbls / stroke

(PL) DYNAMIC **P**RESSURE **L**OSS [psi]

SLOW PUMP RATE DATA:	PUMP NO. 1	PUMP NO. 2
SPM		
SPM		

CURRENT WELL DATA::

CURRENT DRILLING MUD:

WEIGHT ppg

CASING SHOE DATA:

SIZE inch

M. DEPTH feet

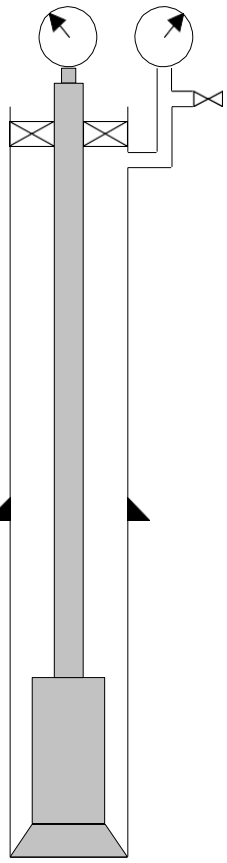
T.V. DEPTH feet

HOLE DATA:

SIZE inch

M. DEPTH feet

T.V. DEPTH feet



PRE-RECORDED VOLUME DATA:	LENGTH feet	CAPACITY bbls / foot	VOLUME barrels	PUMP STROKES 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)** bbls	**(E)** strokes	Min
DC x OPEN HOLE	x		=		
DP / HWDP x OPEN HOLE	x		= +		
OPEN HOLE VOLUME			**(F)** bbls	strokes	Min
DP x CASING	x		=**(G)** +	strokes	Min
TOTAL ANNULUS VOLUME			**(F+G)** = **(H)** bbls	strokes	Min
TOTAL WELL SYSTEM VOLUME			**(D+H)** = (I) bbls	strokes	Min
ACTIVE SURFACE VOLUME			**(J)** bbls	strokes	
TOTALACTIVE FLUID SYSTEM			**(I +J)** bbls	strokes	

International Well Control Forum

Surface BOP Kill Sheet - Vertical Well (API Field Units)

DATE : _____

NAME : _____

KICK DATA : SIDPP [ ] psi SICP [ ] psi PIT GAIN [ ] barrels

KILL MUD WEIGHT

KMW

$$\text{KMW} = \text{CURRENT MUD WEIGHT} + \frac{\text{SIDPP}}{\text{TVD} \times 0.052}$$

..... + _____ = ppg

X 0.052

INITIAL CIRCULATING PRESSURE

ICP

DYNAMIC PRESSURE LOSS + SIDPP

..... + ... = psi

FINAL CIRCULATING PRESSURE

FCP

$$\text{FCP} = \frac{\text{KILL MUD WEIGHT}}{\text{CURRENT MUD WEIGHT}} \times \text{DYNAMIC PRESSURE LOSS}$$

_____ x ..... = psi

(K) = ICP - FCP = ... - ..... = ... psi

$$\frac{(K) \times 100}{(E)} = \frac{\text{X } 100}{\text{}} = \frac{\text{psi}}{100 \text{ strokes}}$$

STROKES	PRESSURE [psi]

STATIC & DYNAMIC DRILL PIPE PRESSURE [psi] ↑

STROKES →