pRoll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY/ JUNE 2025

Date: 02-06-2025 **Time:** 01:00 pm – 04:00 pm

School: SOE	**Program:** B.Tech.-PET	
Course Code: PET2024	**Course Name:** Wellbore Problems and Mitigation	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	00	30	20	50	-

Instructions:

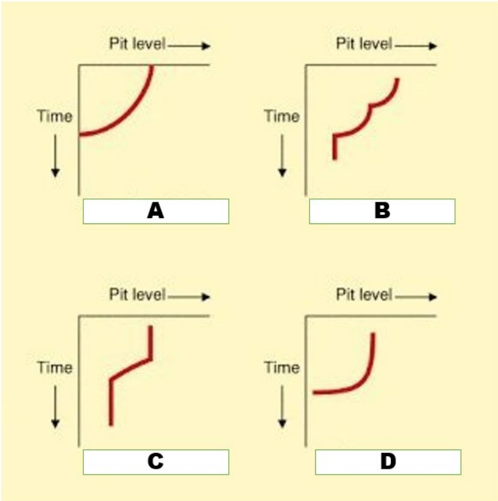
(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Define “Blind Drilling” and mention one recommendation to do so.	2 Marks	L1	CO2
2.	Distuinguish between “Seepage” and “Partial” Loss circulation.	2 Marks	L1	CO2
3.	The figure shows four typical pit level versus time responses observed during a formation evaluation test. Match the following formation characteristics with their corresponding graph patterns: a) Pores/Perm Matrix b) Natural Fractures c) Induced Fracture d) Cavernous Graph Patterns:	2 Marks	L1	CO2

	i) Gradual upward curve ii) Multiple step-like increases iii) Two distinct sharp increases iv) Sharp rapid increase near the beginning  			
4.	Name some of the Fiber and Granular LCM materials.	**2 Marks**	**L1**	**CO2**
5.	State the any two consequences of Loss circulation while drilling.	**2 Marks**	**L1**	**CO2**
6.	State any two consequence of Blowout.	**2 Marks**	**L1**	**CO4**
7.	Identify the appropriate options. **I. The primary function of ______ is to strengthen the wellbore walls and prevent fluid loss into permeable formations.** (A) Casing / (B) Cement slurry / (C) Drilling mud / (D) Liner hanger **II. ______ is a type of well control incident where formation fluids enter the wellbore due to lower hydrostatic pressure.** (A) Blowout / (B) Kick / (C) Mud loss / (D) Fracture gradient **III. The ______ is a downhole tool used to direct drilling fluid flow and provide rotational force to the drill bit without rotating the drill string.** (A) Rotary table / (B) Mud motor / (C) Annular preventer / (D) Choke line **IV. The ______ is a set of heavy steel pipes placed in the hole to provide weight and stability to the drill bit and bottomhole assembly.** (A) Drill collar / (B) Kelly / (C) Drill pipe / (D) Stabilizer	**2 Marks**	**L1**	**CO4**
8.	Identify True/False type questions on Well Control: I. The primary function of a Blowout Preventer (BOP) system is to prevent uncontrolled flow of formation fluids during drilling operations.	**2 Marks**	**L1**	**CO4**

	II. The annular BOP can only seal around the drill pipe and cannot seal when the drill pipe is absent from the wellbore. III. The kill manifold is used to control the flow of fluids during a well kill operation by introducing heavier mud into the wellbore. IV. Choke manifolds are designed to regulate the flow of drilling mud in both kick and well control situations by maintaining the pressure in the wellbore.			
9.	Match the following:	**2 Marks**	**L1**	**CO4**
10.	Name the two outlets of Drilling Spool and state their application/	**2 Marks**	**L1**	**CO4**

Column A (BOP Type)	**Column B (Function/Application)**
A. Annular BOP	1. Used for sealing the wellbore by compressing a rubber sealing element around the drill pipe.
B. Ram BOP (Pipe Rams)	2. Used to seal the wellbore in case of a kick, by closing around a specific diameter of the pipe.
C. Blind Ram BOP	3. Used to seal off the wellbore in the absence of a drill pipe, providing a tight seal for well control.
D. Shear Ram BOP	4. Designed to cut through the drill pipe while simultaneously sealing the wellbore.

Part B

Answer the Questions. **Total Marks 80M**

11.	Discuss the causes, types, and impacts of loss circulation during drilling operations. Explain the formation characteristics that contribute to it, and suggest effective mitigation and treatment strategies.	**20 Marks**	**L2**	**CO2**
	Or			
12.	Explain the procedure for reporting and diagnosing mud circulation loss during drilling. Describe how to identify the loss zone, the types and causes of loss circulation, and discuss preventive measures and the role of different Loss Circulation Materials (LCMs) in managing it.	**20 Marks**	**L2**	**CO2**

13.	**a.**	Classify and explain primary and secondary kick indicators during drilling, with examples. Discuss how early detection aids in timely well control and enhances operational safety.	**14 Marks**	**L2**	**CO4**
	b.	Distinguish between SRRA and RSRA configurations in a Blowout Preventer (BOP) system. Illustrate your answer with a labeled diagram highlighting their structural and functional differences.	**06 Marks**	**L2**	**CO4**
		Or			

14.	**a.**	Classify the types of Blowout Preventers (BOPs), focusing on Annular and Ram-type BOPs. Explain their functions and discuss how their use depends on wellbore pressure and formation conditions.	**10 Marks**	**L2**	**CO4**
	b.	Explain the pressure variations during a well killing operation. Using a labeled diagram, illustrate key stages such as shut-in pressure, kick tolerance, and circulation pressures. Discuss their influence on decision-making and the effectiveness of the kill method.	**10 Marks**	**L2**	**CO4**

15.	Case Study: *Well Control During a Kick at 11,500 ft in a 12.25" Hole* During drilling, a kick occurred at 11,500 ft. Shut-in pressures recorded: DPSIP = 300 psi, CSIP = 600 psi. The last casing (13.375", ID 12.415", set at 9,000 ft) and the bottom-hole assembly (6.5" OD drill collars, 400 ft) were in place. Drillpipe specs: 5.5" OD, 4.276" ID. Mud weight: 9.5 ppg (0.494 psi/ft). Circulation pressures: 2,200 psi @ 50 spm, 800 psi @ 25 spm. Pump output: 0.12 bbl/stroke. i. Compute internal capacities of drillpipe and drill collars (bbl/ft). ii. Calculate annular capacity between drillpipe and open hole (bbl/ft). iii. Estimate formation pressure at kick depth. iv. Determine required kill mud weight. v. Compute Initial Circulating Pressure (ICP). vi. Compute Final Circulating Pressure (FCP). vii. Estimate time to displace kill mud through drillpipe. viii. Estimate total time to replace well volume with kill mud. ix. Calculate total pump strokes required for kill operation. x. Provide a graph showing drillpipe pressure vs. time and strokes during the kill process.	**20 Marks**	**L3**	**CO4**
	Or			
16.	**Case Study:** *Kick Encounter at 10,000 ft in an 8.5" Hole* While drilling an 8.5" hole at 10,000 ft, a kick occurred and the well was shut in. Recorded pressures: DPSIP = 200 psi, CSIP=400 psi. Casing: 9.625" (ID 8.755"), set at 8,600 ft. Drill collars: 8" OD, 3" ID, 500 ft.	**20 Marks**	**L3**	**CO4**

	Drillpipe: 5” OD, 4.276” ID. Mud weight: 10.0 ppg (75 pcf). Circulation pressures: 2,000 psi @ 60 spm, 500 psi @ 30 spm. Pump output: 0.1 bbl/stroke. i. Compute internal capacities of drillpipe and drill collars (bbl/ft). ii. Calculate annular capacity between drillstring and open hole (bbl/ft). iii. Estimate formation pressure at kick depth. iv. Determine required kill mud weight. v. Compute Initial Circulating Pressure (ICP). vi. Compute Final Circulating Pressure (FCP). vii. Estimate time to displace kill mud through drillpipe. viii. Estimate total time to circulate kill mud through wellbore. ix. Calculate total pump strokes for kill operation. x. Plot drillpipe pressure vs. time and strokes using calculated values.			

17.	**a.**	Explain abnormal formation pressure and classify the key geological and operational factors that contribute to its occurrence. Explain the mechanisms behind its development and assess its impact on drilling safety and well control strategies.	**10 Marks**	**L2**	**CO3**
	b.	Explain how Measurement While Drilling (MWD), Repeat Formation Tester (RFT), and Drill Stem Test (DST) assist in detecting and evaluating abnormal pore pressures during drilling operations. Describe the specific role of each technique in pressure assessment.	**10 Marks**	**L2**	**CO3**
		Or			
18.		Describe the application of Measurement While Drilling (MWD), Repeat Formation Tester (RFT), and Drill Stem Test (DST) in identifying and estimating abnormal pore pressures. Additionally, compare empirical, well logging, and seismic methods for detecting abnormal pressures, citing examples of geological processes linked to each approach.	**20 Marks**	**L2**	**CO3**