Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 20- 05-2026 **Time:**01:00pm – 04:00pm

School: SOE	**Program:** B.Tech.-PET	
Course Code: PET3005	**Course Name:** Multilateral and Horizontal Well Technology	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	6	22	12	32	28

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.	Outline the productivity index for a horizontal well according to S. Joshi's type relationship.	**2 Marks**	**L1**	**CO3**
2.	State the two types of Rotary Steerable Systems used for deviated wells.	**2 Marks**	**L1**	**CO1**
3.	Tabulate the formula to determine the Dog Leg angle of two lateral stations having their measured depths, inclinations and azimuths.	**2 Marks**	**L1**	**CO1**
4.	Identify the challenges associated with extended reach drilling.	**2 Marks**	**L1**	**CO1**
5.	Relate 'Rentry' with 'Sidetracking' used in multilateral wells.	**2 Marks**	**L1**	**CO2**
6.	Recognise the situation under which tubing head pressure varies frequently, even when the production rate remains constant.	**2 Marks**	**L1**	**CO5**
7.	Identify the flow regimes associated with vertical two-phase flow in a production well.	**2 Marks**	**L1**	**CO5**
8.	Describe the bean performance as the third phase of a flowing well.	**2 Marks**	**L1**	**CO5**

9.	Outline the reasons behind the occurrence of oil and gas coning in a wellbore, supported by the basic mathematical idea.	**2 Marks**	**L1**	**CO5**
10.	Define the Memory Open Hole Logging tool used in complex wells.	**2 Marks**	**L1**	**CO4**

Part B

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

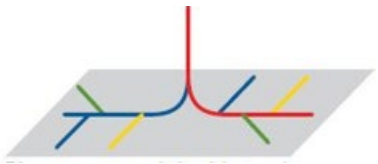
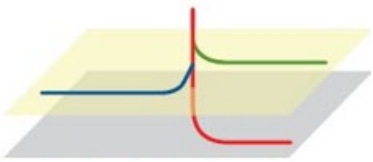
11.	Illustrate how the maximum horizontal well length varies with different build-up radii (ultra-short, short, medium, and long radius) within a 100-acre lease area, considering state restrictions that prohibit crossing the lease boundary and require maintaining a 150 ft offset from the boundary. Classify the possible well placements (central or diagonal) and compare how each drilling technique (based on build-up radius) influences the feasible well length and trajectory inside the lease boundary.	**10 Marks**	**L3**	**CO3**
	Or			
12.	The following parameters apply to an oil well having an estimated drainage area of 80 acres. k = 1md h = 60 ft P_e = 2500 psi P_{wf} = 900 psi Bo = 1.25 RB/STB μ_o = 0.6 cp Calculate a) the steady state flow rate and b) the skin factors, for effective wellbore radii of 0.35, 0.1, and 20 ft. The drilled wellbore radius is 0.3 ft.	**10 Marks**	**L3**	**CO3**

13.	Demonstrate the working of the SP Log for the identification of permeable and impermeable formations using two voltage difference phenomena (Liquid Junction Potential & Membrane Potential)	**10 Marks**	**L3**	**CO4**
	Or			
14.	Interpret the working principle of (any two): i. CBL-VDL Log ii. MWD-LWD Tools iii. PLT Tools iv. Sonic Log	**10 Marks** **(5+5)**	**L3**	**CO4**

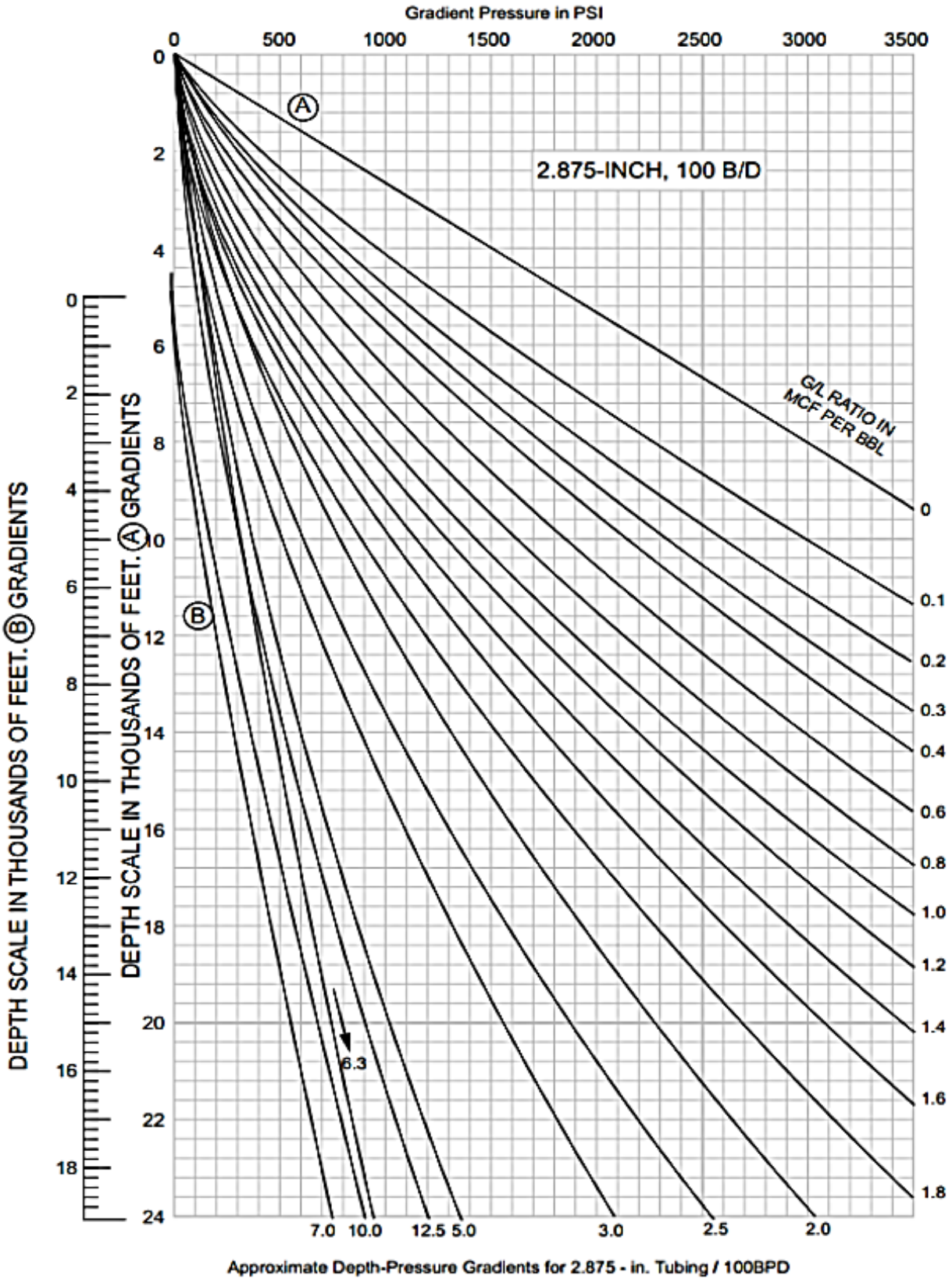
15.	Classify the low and high natural radioactivity rock formations and its response to the Gamma Ray Log. Demonstrate how porosity (Density, Neutron & Sonic) logs help to interpret the hydrocarbon trap zones.	**10 Marks**	**L3**	**CO4**
	Or			

16.	Illustrate how the Nuclear Magnetic Resonance (NMR) log functions in determining formation properties such as porosity and fluid characterisation. Examine how variations in T_1 and T_2 relaxation times can be applied to interpret different reservoir conditions, including pore-size distribution, fluid type, and wettability.	**10 Marks**	**L3**	**CO4**

17.	Demonstrate, with reference to well performance behaviour, the key challenges faced during well test analysis of horizontal wells. Explain how factors such as well geometry, anisotropy, reservoir heterogeneity, and boundary effects influence the interpretation of pressure-transient data and productivity evaluation.	**10 Marks**	**L3**	**CO3**
	Or			
18.	Explain the various types of Non-focussed and Focussed Resistivity tools used for the detection of hydrocarbon-bearing formations. Define the Induction logging tool.	**10 Marks**	**L3**	**CO3**

19.	a. Distinguish the various TAML Levels (1-6) under Schlumberger Multilateral Configuration with proper diagrams. b. Explain why handling of pressure in a multilateral well is challenging. c. Identify the type of lateral designs (shown below) used in multilateral wells. i.  ii. 	**20 Marks** **(12+4 +3)**	**L2**	**CO2**
	Or			
20.	a. Describe the whole mechanism of 'Constant Bottomhole Managed Pressure Drilling', 'Pressurised Mud Cap Managed Pressure Drilling' and 'Dual Gradient Managed Pressure Drilling'. b. Managed Pressure drilling was decided to conduct with mud weight (MW) = 9.0 ppg, TVD = 8,500 ft. The pressure windows exist between pore pressure (PP) = 8.2 ppg equivalent and fracture gradient (FG) = 9.8 ppg equivalent. During connections, Annular Pressure Loss (APL) drops to 0 psi. Predict the required Surface Backpressure (SBP) to hold static BHP at 9.2 ppg mud. Then, at static ECD target 9.5 ppg with circulating APL=180 psi, verify if SBP needs adjustment.	**20 Marks** **(15+5)**	**L2**	**CO2**

21.	a. Calculate the flowing pressure at the foot of 13000 ft of $2\frac{7}{8}$ -in tubing if the well is flowing 100 bbl/day, having GLR of 1mcf/bbl with a tubing head pressure of 200 psi. (Use the Gilbert's curve) b. A flowing well with 3000 ft of tubing in the hole exhibits a casing head pressure (CHP) of 550 psig when the production rate is 42 bbl/day and of 320 psig when the production rate is 66 bbl/day. Calculate the PI of this well, its static pressure, its potential and BHP when the production rate increases to 75 BPD. c. Diagrammatically break down the possible pressure losses in various nodes of all three phases (Inflow performance, Vertical lift performance and bean performance).	**20 Marks** **(6+8+ 6)**	**L4**	**CO5**
	Or			
22.	A mature sandstone reservoir has entered the late stage of production through several vertical wells. These wells now show declining oil rates, early water breakthrough, and low overall recovery efficiency (≈25%). The operator is considering a horizontal well development plan to rejuvenate production and enhance ultimate recovery. (a) Illustrate the main problems and limitations observed in the existing vertical wells. (b) Interpret the advantages of horizontal wells in improving reservoir performance and recovery. (c) Determine the technical challenges and operational issues associated with horizontal wells, and suggest possible mitigation measures.	**20 Marks**	**L4**	**CO5**


Gradient Pressure in PSI
0
500
1000
1500
2000
2500
3000
3500
2.875-INCH, 100 B/D
Ⓐ
Ⓑ
G/L RATIO IN MCF PER BBL
0
0.1
0.2
0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
6.3
7.0
10.0
12.5
5.0
3.0
2.5
2.0
DEPTH SCALE IN THOUSANDS OF FEET. Ⓐ GRADIENTS
DEPTH SCALE IN THOUSANDS OF FEET. Ⓑ GRADIENTS
Approximate Depth-Pressure Gradients for 2.875 - in. Tubing / 100BPD