Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 12-12-2025 **Time:** 01:00pm– 04:00pm

School: SOE	**Program:** B.Tech. (PET)	
Course Code: PET3011	**Course Name:** Well Intervention Technologies	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	-	-	26	26	26	22

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 2 marks. **10Q x 2M=20M**

1.	**Select the Odd One Out – Carbonate Acidizing** A. Hydrochloric acid (HCl), Mud acid (HCl + HF), Polyacrylamide gel, Citric acid B. Hydrochloric acid (HCl), Mud acid (HCl + HF), Citric acid, Slickwater fracking fluid	**2 Marks**	**L1**	**CO3**
2.	**Match the following:** **Column A** / **Column B** A) Reduce skin factor — 1) Sandstone scale removal B) Increase near-wellbore permeability — 2) Dissolve carbonate near wellbore C) Dissolve silicate scales — 3) Use as a replacement for HCl D) Organic acid treatment — 4) Improve flow efficiency around the wellbore	**2 Marks**	**L1**	**CO3**
3.	Define Mud Acid and mention the concentration of “Weak mud acid”.	**2 Marks**	**L1**	**CO3**

4.	Outline the difference between Inorganic Acid and Organic Acid used in Matrix Stimulation.	**2 Marks**	**L1**	**CO4**
5.	Define fracture half-length in the context of hydraulic fracturing.	**2 Marks**	**L1**	**CO4**
6.	State the role of proppent in hydraulic fracturing.	**2 Marks**	**L1**	**CO4**
7.	**Match the following** **Column A** / **Column B** A) Fracture height — 1) Fracture segment extending from wellbore B) Fracture width — 2) Horizontal opening of the fracture C) Fracture tip — 3) Vertical propagation of the fracture D) Fracture wing — 4) End of the fracture away from the wellbore	**2 Marks**	**L1**	**CO5**
8.	Mention two mechanical method of sand control.	**2 Marks**	**L1**	**CO5**
9.	State the difference between openhole and cased-hole sand control.	**2 Marks**	**L1**	**CO5**
10.	Define erosion in the context of sand production.	**2 Marks**	**L1**	**CO6**

Part B

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

11.	Explain the mechanisms through which matrix stimulation can inadvertently cause formation damage, and illustrate your answer with relevant examples from carbonate and sandstone reservoirs.	**20 Marks**	**L2**	**CO4**
	Or			
12.	A clastic reservoir with quartz, illite, mixed clays, and trace K-feldspar was treated with 12% HCl + 3% HF mud acid. High Ca^{2+} and Na^{+} in the brine led to CaF_2 and silica gel precipitation after an overnight soak, reducing well productivity. Explain the causes of stimulation failure and suggest preventive strategies.	**20 Marks**	**L2**	**CO4**

13.	A rock formation contains a reactive mineral ABC uniformly distributed in the matrix. A preflush solution of 15 wt% P_2O_4 (specific gravity = 1.09) is planned to be injected ahead of the HF/HCl stage to dissolve all ABC in the near-wellbore region and create a low-pH environment. The symbolic unbalanced reaction is: $ABC + P_2O_4 \longrightarrow AP + BQ + CQ$ **Data and Assumptions:**	**20 Marks**	**L4**	**CO3**

Parameter	Value
Wellbore inner radius	0.328 ft
Radial treatment region	1 ft beyond wellbore
Formation porosity	0.20 (fraction)
Volume fraction of ABC in rock (bulk)	0.25
Bulk density of formation	190 pcf
Acid solution	15 wt% P_2O_4, specific gravity 1.09
Atomic/molecular weights ($g \bullet mol^{-1}$)	A = 12, B = 14, C = 40, P = 2, Q = 16
Assumptions	Reaction goes to completion; all ABC is reactive; no side reactions; ignore temperature effects and gas expansion

Calculate the minimum preflush volume required in gallons per foot of pay zone, using $1ft^3$=7.48052gallons. Perform the calculation on a mass/mole basis.

Or

14. You are planning a safe acidizing treatment for a low-permeability sandstone pay. Due to the risk of fractures and nearby facilities, the operator requests a 300-psi safety margin below the measured fracture pressure.

20 Marks **L4** **CO3**

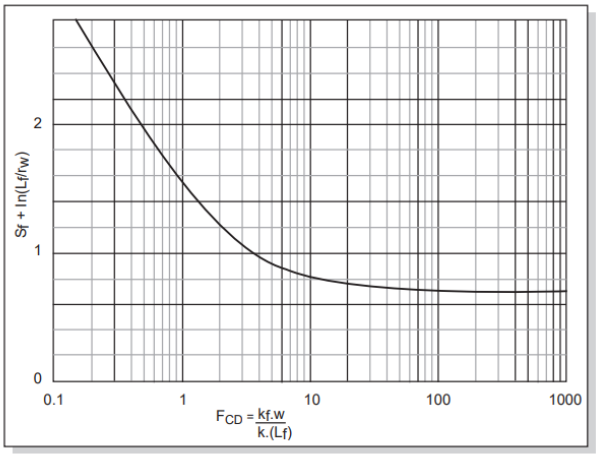
Well / Reservoir Data:

Parameter	Value
Pay zone depth	9,500 ft
Pay thickness	60 ft
Permeability	50 mD
Wellbore radius	0.328 ft
Reservoir pressure	4,000 psia
Drainage radius	1,000 ft
Fracture gradient	0.7 psi/ft
Coil tubing ID	2.00 in
Acid SG	1.07
Acid viscosity	1.5 cP
Safety margin	300 psi

(a) Calculate the maximum acid injection rate (bbl/min or gpm) such that bottom-hole pressure does not exceed the fracture limit minus 300 psi, including frictional losses in the coil tubing.

(b) Calculate the maximum surface injection pressure (psia) needed to deliver this rate, accounting for hydrostatic head and tubing friction.

Assumptions: Single-phase, incompressible flow; neglect temperature effects.

15.	**a.**	You are a service company representative who has designed the following fracturing treatment: Wellbore radius (r_w): 0.328 ft Reservoir height: 200 ft; bounded by competent shales Reservoir Permeability (k): 1.0 mD Proppant to be used: 500,000 lb Design Fracture Conductivity (kf*w): 1,500 mD*ft at 4 lb/ft2 proppant loading Use the Cinco-Ley and Samaniego type graph (below) to calculate the expected well negative skin (the fracture treatment covers the full formation height) to advise your client. Do you think this is the optimum fracturing treatment for this well?  Lf is fracture half length	**10 Marks**	**L3**	**CO6**
	b.	The operator you are working for notices the above and queries whether this is an optimum fracturing treatment design. However, he says that he is already over budget so you are not allowed to increase the size of the hydraulic fracturing treatment but commissions laboratory tests that show a fracture of Fracture Conductivity (kf*w) of 2,500 mD*ft can be expected at proppant loading of 7 lb/ft^2 and 3,500 mD*ft at proppant loading of 10 lb/ft^2. Interpret both the results and advise the operator as to which fracture design is optimum and why.	**10 Marks**	**L3**	**CO6**
Or					
16.	**a.**	A gas reservoir has a permeability of 2.0 md, which is to be fractured hydraulically to create a 750 m long and 0.40 cm wide fracture of 3 × 10^5 mD permeability around the centre of damage area. Calculate the fracture conductivity for the well (rounded off to two decimal places).	**10 Marks**	**L3**	**CO6**

	b.	A hydraulically fractured vertical well has fracture permeability of 5500 mD, reservoir permeability of 90 mD, fracture width of 0.26 in, and fracture half-length of 6000 ft. Calculate Dimensionless fracture conductivity.	**10 Marks**	**L3**	**CO6**

17.	Explain how production and completion practices, as well as mechanical sand control screens, help mitigate sand production in a well. In your answer: I. Discuss production and completion strategies that reduce sand production without using chemical or mechanical treatments, with brief reasoning. II. Describe the construction, operation, advantages, and limitations of slotted pipes, wire-wrapped screens, and resin-coated pre-packed screens, and compare them based on inflow area, mechanical strength, slot size accuracy, and typical field applications.	**20 Marks**	**L2**	**CO5**
	Or			
18.	Explain how sand production during oil or gas production can negatively affect well performance and surface facilities. Discuss gravel packing as a sand control technique, including its advantages, disadvantages, and examples of scenarios where it is effective or unsuitable.	**20 Marks**	**L2**	**CO5**