Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 24 – 12- 2025 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B.Tech.-PET	
Course Code: PET2019	**Course Name:** Oil and Gas Well Test Analysis	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	18	20	14	28	20

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.	State the uses of 'Ideal Reservoir Model'.	**2 Marks**	**L1**	**CO1**
2.	Tabulate the basic differential equation for the radial flow of a fluid in a homogeneous porous medium.	**2 Marks**	**L1**	**CO1**
3.	Define 'Radius of investigation' for a constant flow rate in a homogenous reservoir.	**2 Marks**	**L1**	**CO1**
4.	Label the 'Layered Reservoir Test', which is used in an oil well testing.	**2 Marks**	**L1**	**CO3**
5.	An oil well has a flowing bottom-hole pressure of 3000 psi, and the reservoir has an average pressure of 3250 psi. A pressure build-up test reveals that the slope of the straight-line portion of Horner's plot is 38.5 psi/cycle, and the skin factor of the well is 3. Identify the flow efficiency of this well.	**2 Marks**	**L1**	**CO3**
6.	Identify the wellbore storage mechanisms that lead to a drop in pressure during a drawdown test.	**2 Marks**	**L1**	**CO4**

7.	For reservoirs with circular, square, and rectangular drainage areas having a centrally located well, the Dietz shape factors are *C1, C2* and *C3*, respectively. Arrange these shape factors in descending order.	**2 Marks**	**L1**	**CO4**
8	Using mathematical reasoning, outline the method for determining when the wellbore storage effect ceases and the semi-log straight line portion appears on a Horner plot.	**2 Marks**	**L1**	**CO4**
9.	State significant benefits of using a multirate test instead of conventional pressure build-up or drawdown tests.	**2 Marks**	**L1**	**CO4**
10.	Compute the governing equation for radial flow in a reservoir under semi-steady-state conditions, clearly labelling each variable and parameter.	**2 Marks**	**L1**	**CO1**

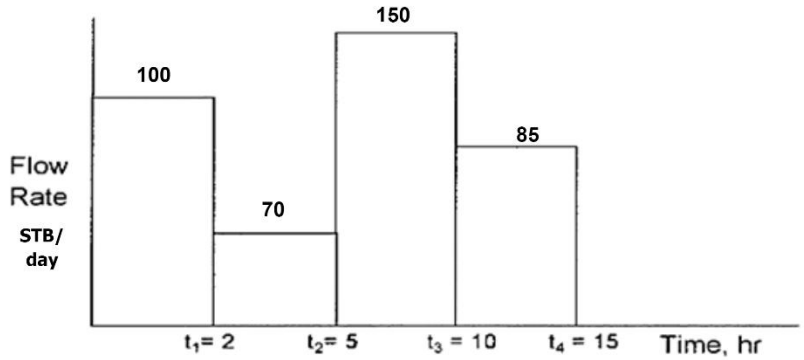
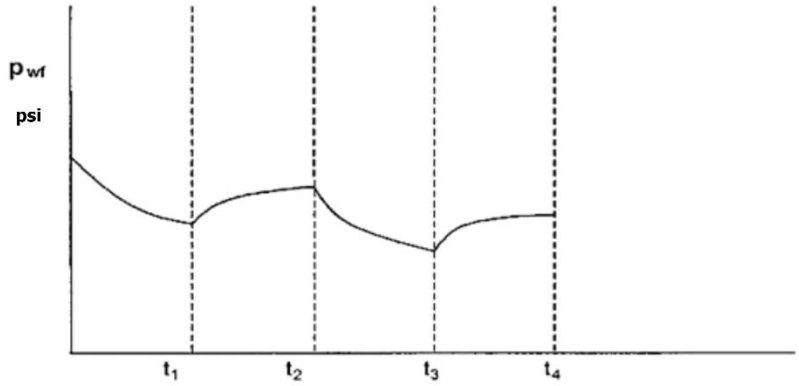
Part B

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

11.	**a.**	Describe 'Absolute Open Flow Potential' in a gas well.	**2 Marks**	**L2**	**CO5**
	b.	Distinguish between the 'Isochronal' and the 'Modified Isochronal' test.	**3 Marks**	**L3**	**CO5**
	c.	Diagrammatically sketch the Inflow performance relationships for both the deliverability tests mentioned above.	**5 Marks**	**L4**	**CO5**
		Or			
12.	**a.**	Describe 'Conventional backpressure test'.	**3 Marks**	**L2**	**CO5**
	b.	The value of slope (n) in a log-log plot of a deliverability test ranges from 0.5 to 1. Predict the reasons if it decreases or increases beyond this range.	**3 Marks**	**L3**	**CO5**
	c.	Given the following data: k = 6.282 md, Average Reservoir Pressure = 3700 psia, Φ = 0.1004, μ_g =0.02350 cP, r_e = 2200ft, t = 147.2hr. Calculate the Radius of Investigation.	**4 Marks**	**L4**	**CO5**

13.	Breakdown step-by-step the fundamental flow equation for a gas reservoir by applying the real gas law and subdivide performance constant and flow regimes based on the '*n*' value developed by Elenbaas and Katz in 1936.	**10 Marks**	**L4**	**CO5**
	Or			

14.	A modified isochronal test was conducted on a gas well located in a reservoir that had average wellhead and reservoir pressures of 2388 psia and 3700 psia, respectively. The well was flowed on four choke sizes: 16, 24, 32, and 48 inches. The flow rate, wellhead, and flowing bottom-hole pressures were measured at 6 hr for each choke size. An extended test was conducted for a period of 24 hr at a rate of 6.148 mmscfd at which time Pw and Pwf were measured at 1015 and 1727 psia. Well test data are presented in the Tables below. **Duration (hr) and Sequence** / **Bottom-hole Pressure (psia)** / **Choke Size (inches)** / **Flow Rate (mmscf/d)** 147.12 (Initial shut-in) — 3700 — — 6 (Flow 1) — 3144 — 16 — 2.397 6 (Shut-in) — 3700 — — — 6 (Flow 2) — 2566 — 24 — 5.214 6 (Shut-in) — 3700 — — — 6 (Flow 3) — 2158 — 32 — 6.144 6 (Shut-in) — 3698 — — — 6 (Flow 4) — 1836 — 48 — 7.186 22.75 (Shut-in) — 3690 — — — 24 (Extended) — 1727 — 32 — 6.148 Determine the AOF of the well theoretically and graphically.	**10 Marks**	**L4**	**CO5**
15.	Distinguish the radius of investigation under different pressure disturbances from the sandface to the reservoir boundary as a function of time: i) shut-in, ii) Constant flow rate, iii) Constant bottomhole pressure.	**10 Marks**	**L2**	**CO1**
	Or			
16.	Generalise the transient state for an infinite acting reservoir and pseudo-steady state conditions for a bounded reservoir. Describe how a steady state condition in a reservoir can be appropriate.	**10 Marks**	**L2**	**CO1**
17.	Analyse the estimation method to determine the Reservoir Drainage size using two build-up tests.	**10 Marks**	**L4**	**CO3**
	Or			
18.	**a.** Interpret between ‘wellbore damage’ and ‘wellbore storage’.	**5 Marks**	**L3**	**CO3**
	b. Calculate the skin factor and the effective wellbore radius resulting from the invasion of the drilling fluid to a radius of 2 feet. The permeability of the skin zone is estimated at 20 md as compared with the unaffected formation permeability of 60 md. The wellbore radius is 0.25 ft.	**5 Marks**	**L4**	**CO3**

19.	**a.**	Determine the assumptions made by Matthews and Russell in the year 1967 for the proposal of a solution (Ei Function) to the diffusivity equation.	**4 Marks**	**L3**	**CO2**
	b.	Illustrate the linear diffusivity equation for transient flow in a porous medium, where the total time is considered in hours.	**16 Marks**	**L3**	**CO2**
		Or			
20.		Figure below shows the rate history of a well that is producing under transient flow condition for 15 hours. Given the following data: pi = 5000 psi h = 20′ Bo = 1.1 bbl/STB φ = 15% μ_o = 2.5 cp r_w = 0.3′ $c_t = 20 \times 10{-}6$ psi−1 s = 0 k = 40 md Calculate the sand face pressure after 15 hours  	**20 Marks**	**L3**	**CO2**

21.	**a.**	Illustrate how the Pressure Drawdown Test works and the interpretation of various parameters in Earlougher's Semi-Log plot.	**10 Marks**	**L2**	**CO4**
	b.	The following data are given for an oil well that is scheduled for a drawdown test: • Volume of fluid in the wellbore = 180 bbls • Tubing outside diameter = 2 inches	**10 marks**	**L3**	**CO4**

		• Production casing inside diameter = 7.675 inches • Average oil density in the wellbore = 45 lb/ft^3 h = 20 ft φ = 15% r_w = 0.25 ft μo = 2 cp k = 30 md s = 0 $c_t = 20 \times 10^{-6}$ psi^{-1} $c_o = 10 \times 10^{-6}$ psi^{-1} If this well is placed under a constant production rate, calculate how long it will take for wellbore storage effects to end.			
Or					
22.	A drawdown test was conducted on a discovery well. The well was allowed to flow at a constant flow rate of 175 STB/day. The fluid and reservoir data is given below: S_{wi} = 25%, ϕ = 15%, h = 30 ft, $C_t = 18 \times 10^{-6}$ psi^{-1} r_w = 0.25 ft, P_i = 4680 psi, μ_o = 1.5 cp, B_o = 1.25 bbl/STB Assume no wellbore storage and calculate: (a) The average permeability; (b) The skin factor; (c) The pressure drop due to skin. (d) The radius of investigation after 3 days; (e) The flow efficiency. The drawdown test data is given below: **(Semi-Log graph required)**	**20 Marks**	**L3**	**CO4**

t (hr)	**P_{wf} (psi)**
0.6	4388
1.2	4367
1.8	4355
2.4	4344
3.6	4334
6.0	4318
8.4	4309
12.0	4300
24.0	4278
36.0	4261

t (hr)	**P_{wf} (psi)**
48.0	4258
60.0	4253
72.0	4249
84.0	4244
96.0	4240
108.0	4235
120.0	4230
144.0	4222
180.0	4206