Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, Dec 2022

Programme Name: M.Tech., PE — **Semester :** I

Course Name : Reservoir Engineering — **Time :** 03 hrs

Course Code : PEAU 7002 — **Max. Marks :** 100

Nos. of page(s) : 2

Instructions: 1. Assume any data missing.
2. Maintain a minimum of three decimal accuracy.

SNo	SECTION A (5*4=20M)	Marks	CO
Q 1	Define permeability and list various types of permeabilities based on the fluids phases.	**4**	**CO1**
Q 2	Define effective porosity and mention its significance.	**4**	**CO1**
Q 3	Define cricondentherm and retrograde condensation.	**4**	**CO2**
Q 4	Define Darcy's law.	**4**	**CO3**
Q 5	List various types of decline curves used to analyze production rate.	**4**	**CO4**
	SECTION B (4*10=40M)		
Q 6	Describe with a neat diagram the saturation method for estimating the pore volume of a rock sample.	**10**	**CO1**
Q 7	Explain with a neat diagram the multi-component phase diagram of petroleum reservoir fluids.	**10**	**CO2**
Q 8	Derive an expression for radial flow rate Q of compressible gas with a viscosity of μ_g, flowing to a well bore of radius r_w under steady-state condition through a cylindrical geometry formation of permeability κ_g . Or A core is 3 in. long and 2 cm in diameter. When the core is maintained at an upstream pressure was 29.4 psia and downstream pressure was 14.7 psia, a flow rate of 10 cm^3/sec of air (μ = 0.018 cp) was recorded at downstream pressure. Calculate the permeability of the core in darcys.	**10**	**CO3**
Q9	The production rate-time relationship for the hyperbolic analysis is given by $$q = q_i\,(1 + n\,D_i t)^{-1/n}$$ From the above equation, derive for the production rate-cumulative production relationship given by $$N_D = \frac{{q_i}^n}{(n-1)\,D_i}\,(q^{1-n} - {q_i}^{1-n})$$	**10**	**CO4**
	SECTION-C (2*20=40M)		
Q10	Explain the various factors impacting the flow of fluids through porous hydrocarbon reservoirs.	**20**	**CO3**
Q11	Deduce the following General Material Balance equation	**20**	**CO4**

$$\frac{\mathrm{N}(B_t - B_{ti})}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]} + \frac{\frac{NmB_{io}}{B_{gi}}\left(B_g - B_{gi}\right)}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]}$$

$$+ \frac{NB_{oi}(1+m)\left(\frac{C_w Sw_i + C_f}{1 - SW_i}\right)\Delta\mathrm{P}}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]} + \frac{W_e - B_w W_p}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]} = 1$$

or

i. List various methods available to estimate oil and gas reserves.

ii. Derive for the production rate versus time and the production rate versus cumulative production expressions using exponential decline analysis.