Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, December 2020

Course:	**Reservoir Engineering I**	**Semester:**	**V**
Program:	**B. Tech. APEUP**	**Time:**	**03 hrs.**
Course Code:	**PEAU 3002**	**Max. Marks:**	**100**

Instructions: All questions are compulsory.

SECTION A

1. Each question will carry 5 marks
2. Instruction: Select the correct answer(s)

Q 1	i.	The basic properties of that determine a reservoir rock's hydrocarbon storage capacity are A. Porosity and permeability B. Porosity and water saturation C. Porosity and grain density D. Porosity and capillary pressure	CO1
	ii.	Below critical saturation, the fluid remains in the pores and, for all practical purposes, A. Will not flow B. Partially flow C. Have normal flow D. None of the above	
	iii.	Leverett realized that capillary pressure depends on A. Porosity, B. Interfacial tension. C. Mean pore radius di, D. All of the above	
	iv.	In Reservoir Engineering calculations which of the following porosity is used A. Absolute porosity B. Effective porosity C. Both of the above D. None of the above	
	v.	Carbonate may have porosity in the range of A. 0.54 - 1.40 % B. 3.50 - 29 % C. 6 - 50 % D. 0.65 - 33 %	
Q 2	i.	What will be the effect on permeability when specific surface decreases? A. Decrease	CO2

	B. Increase C. Remains same D. None of the above ii. Which of the following statement is true? A. When Sw = one. kw = k and rock is entirely saturated with water B. When So < Soc. there will be no oil flow and ko =0. C. When So = 1, ko = k and rock is entirely saturated with oil D. All of the above iii. Which of the following statement is true? A. The value of Sw at krw = 0 is called the Swc B. The value of So at kro = 0 is called the Soc C. When relative permeability of a phase is zero, there is still a considerable saturation of this phase D. All of the above iv. Darcy's Law applies only when there is A. Laminar (viscous) flow B. Semi-Steady-state flow C. Compressible fluids D. All of the above v. Which of the following are data sources for determine rock permeability A. Cores B. Seismic velocity surveys C. Rate of penetration during drilling D. Bottom hole flowing pressure	
Q 3	i. If formation volume factor for under saturated oil reservoir is plotted against pressure A. The formation volume factor remain constant from initial reservoir pressure to bubble point pressure and it start declining below bubble point pressure B. The formation volume factor start declining from initial reservoir pressure and continue declining below bubble point pressure also C. The formation volume factor first increase from initial reservoir pressure to bubble point pressure and it start declining below bubble point pressure D. The formation volume factor remain constant from initial reservoir pressure to bubble point pressure and will remain constant even below bubble point pressure ii. For determining the bubble point pressure, which of the following experiment is carried out during PVT analysis. A. Isothermal Flash B. Constant Composition Expansion (CCE) C. Constant Volume Depletion (CVD) D. Differential Vaporisation (DV) iii. Three pounds of propane is placed in a vessel at 120°F and 60 psia. Assuming an ideal gas behavior, the gas will occupy the an approximate volume at above conditions	CO3

	A. 5 ft^3 B. 6 ft^3 C. 7 ft^3 D. 8 ft^3 iv. The basic properties of gases are commonly expressed in terms of A. The apparent molecular weight, B. Apparent volume, C. Apparent temperature D. All of the above v. The value of gas formation volume factor (Bg) of gas from a reservoir with temperature 200°F and pressure 2500 psia. The Z factor of this is measured as 0.851 A. 0.000132 RB/scf B. 0.001132 RB/scf C. 0.002132 RB/scf D. 0.003132 RB/scf	
Q 4	i. The primary reservoir characteristic are A. Type and number of fluids in the reservoir B. Flow regimes C. Reservoir geometry D. All of the above ii. When a well was drilled, an oil-bearing zone was encounter in the depth between 2020 – 2040 m. However, the well was completed up to the depth of 2030 m. The type of flow oil in to the bottom of well will be A. Linear flow B. Radial flow C. Hemispherical flow D. None of the above iii. The pressure derivative with respect to time is essentially a function of both position i and time t, in case of A. Steady state flow B. Unsteady state flow C. Pseudo steady-state flow D. None of the above iv. The equation q = $\frac{0.001127kA\,(p1-p2)}{\mu L}$ is used for A. Radial flow of compressible fluid B. Linear flow of compressible fluid C. Radial flow incompressible fluid D. Linear flow incompressible fluid v. Which of the following equations are used for the mathematical formulation of the transient-flow equation. A. Continuity Equation B. Quadratic Equation. C. Linear Equation. D. Radical Equation.	CO4

Q 5	i. Select the correct statement from the following A. All reserve estimates involve some degree of uncertainty. B. Availability of reliable geologic and engineering data is chiefly responsible for the uncertainty in the estimation of reserve. C. Reserve estimation is dynamic process and estimation is refined at different stages in the life of field D. All of the above. ii. Proven developed reserves are the reserves A. That can be produced with existing wells B. That can be produced after drilling required number of well C. That can be produced with existing wells after creating production facilities D. All of the above iii. If any reserve is in P50 category, that means A. It needs further development B. It has the probability to exist C. Both (A) and (B) D. None of the above iv. Which method of reserve estimation has the minimum error A. Volumetric, B. Material balance C. Production performance. D. Comparative methods v. Which of the following parameters do you not need to know in order to determine a reservoir hydrocarbon in place? A. Areal extent of the reservoir B. Net thickness C. Permeability D. Porosity	CO5
Q 6	i. Sources of reservoir energy A. Gas dissolved in oil B. Oil overlain by free gas C. Oil underlain by compressed water D. All of the above ii. While producing from a reservoir, the reservoir pressure declines rapidly and continuously, gas-oil ratio increases to maximum and then declines and there is water production. The drive mechanism operating in this reservoir is A. Water drive B. Gas cap drive C. Depletion drive D. Partial water drive iii. The most suitable drive for pressure maintenance is A. Water drive B. Gas drive	CO6

C. Depletion drive
D. All of the above

iv. While producing from a reservoir, the reservoir pressure declines slowly, gas-oil ratio continue to increases to maximum and there is water production. The drive mechanism operating in this reservoir is
A. Water drive
B. Gas cap drive
C. Depletion drive
D. Partial water drive

v. The drive mechanism, which give maximum recovery
A. Bottom water drive
B. Gas cap drive
C. Edge water drive
D. All of the above

SECTION B

1. Each question will carry 10 marks
2. Instruction: Write short / brief notes

S No.	Question	CO
Q 7	The bulk density of a brine saturated core sample is 1.9 gm/c. If the density of brine solution and core matrix are 1.04 gm/cc and 2.55 gm /cc, find the porosity of the formation. Explain the various factors that affect the porosity of a formation.	CO1
Q 8	A. Derive an expression to determine average permeability of layered-parallel beds with different permeability considering all layers have the same width and cross-sectional area with no cross flow. B. Three layers of 6, 7 and 13 feet thick respectively, are conducting fluid in parallel flow. The depth to the top of the first layer is 5,012 feet. Core analysis report shows the following permeability data for each layer.	CO2

Layer1		Layer2		Layer3	
Depth ft	Permeability md	Depth ft	Permeability md	Depth ft	Permeability md
5012-13	485	5018-20	210	5025-28	95
5013-15	50	5020-23	200	5028-30	20
5015-18	200	5023-25	195	5030-32	89
				5032-35	90
				5035-38	86

Calculate the average permeability of the entire pay zone (i.e., 5,012– 5,038′).

Q 9	State the primary natural drive mechanisms encountered in a typical petroleum reservoir with explaining the expected production and pressure profile during the producing life of reservoir under different driving mechanism.	CO6
Q 10	Derive equations for determining the following parameters of a natural gas • Apparent molecular weight • Specific gravity	CO3

	• Density • Gas formation volume factor, Bg	
Q 11	An oil well is producing at a stabilized rate of 1000 STB/day at a stabilized bottom-hole flowing pressure of 3000 psi. Analysis of the pressure buildup test data indicates that the pay zone is characterized by a permeability of 150 md and a uniform thickness of 25 ft. The well drains an area of approximately 40 acres. The following additional data is available: rw = 0.25 ft A = 40 acres Bo = 1.25 bbl/STB μo = 2.5 cp Calculate the pressure profile (distribution) and list the pressure drop across 2 ft intervals from rw to 2 ft, 4 to 6 ft, 20 to 22 ft, 100 to 102 ft, and 700 to 702 ft. and present your observations	CO4
SECTION C **1. Each Question carries 20 Marks.** **2. Instruction: Write long answer.**		
Q 12	**A.** Describe the production decline analysis and its controlling factors. Illustrate in details all types of rate decline behavior and its importance in petroleum industry. B. Determine the original gas in place (OGIP) in scf for the gas reservoir for which average parameters are given below. The initial reservoir temperature is 200 ºF Thickness, h (ft) = 25, Porosity = 0.16, Water Saturation Sw = 0.25, Area = 950 acres, Reservoir Pressure Pr (psi) = 5775 , Gas deviation factor, Z = 0.96 C. Determine remaining gas reserves and recovery factor for the above reservoir when abandonment reservoir pressure is 750 psi. Assume the gas deviation factor at 750 psi and 200 ºF is 0.95.	CO5