B. Tech. V

Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech(Applied Petro.Engg. with Gas Spl) **Semester– Semester 5**

Subject (Course): Reservoir Engineering **Max. Marks : 100**
Course Code : PTEG335 **Duration : 3 Hrs**
No. of page/s: 3(Three)

THIS PAPER CONTAINS 3 (THREE) SECTIONS, ALL THE SECTIONS ARE COMPULSORY

(Assume any missing value)

SECTION - A

There are Five (05) questions of 4 marks each. All questions are compulsory

Question-1

Fill in the blanks:

(a) PRMS is a fully integrated system that provides the basis for all petroleum ---------- and ----------categorization of all petroleum reserves and resources.
(b) PRMS is based on an explicit distinction between---------- Projects and range of ----------.
(c) Reserves may be assigned to the project that -------the requirements for ----------.
(d) Total Petroleum initially in place is described as ----------,----------.----------.and ----------.

Question-2

Define hydrocarbon reserves and list their generic features in oil industry.

Question-3

Volumetric gas engineering calculations involve the use of gas formation volume factor B_g defined the same and give its relation with E_g .

Question-4

Explain the following abbreviations of oil MBE, along with their units & significance:

(1) We (2) m (3) G (4) P.V. (5) c_w

Question-5

Describe MBE of gas reservoir – visualizing it as an idealized gas container with special reference to dry gas reservoir with water drive

Section B

There are Four (4) Questions of 10 marks each. All the questions are compulsory

Question-6

Establish the Gas Material Balance Equation in the P/Z form and indicate its applicability in volumetric gas reservoir as well as the Gas Reservoir with water drive.

Question-7

What are the objectives of Production Decline analysis? Determine the production rate of oil in stb/d after 7.5 years from a reservoir having Slope=-D 1/quarter year as 0.0524 and initial rate 6049.1stb/d using exponential decline.

Question-8

(A) Using volumetric gas reservoir MBE, express the following equations:

(I) The standard cubic feet (scf) of gas initially in place (G),

(II) The cumulative gas produced (G_P) at any pressure,

(III) The recovery Factor

(B) Find the pore volume occupied by gas in a gas cap where gas cap volume to oil zone volume ratio is 4.Initial oil in place is 850STB and Oil formation volume factor is 1.28.

Question-9

Discuss the different aspects of flow of gas in a reservoir and outline the interrelation & estimation of vital gas reservoir monitoring properties.

Section C

There are Two (2) Questions of 20 marks each. Both the questions are compulsory;

Question-10

(a) Calculate the original oil in place for an under saturated reservoir having an initial pressure of 5000 psia and initial oil formation volume factor of 1.305.The following data applies at 3350 psia (P_b = 2750 psia):

N_p = 1,510,000 STB B_o= 1.330 Φ = 10% S_w = 21.6%

$C_o = 1.5 \times 10^{-5}$ psi^{-1} $C_f = 3 \times 10^{-7}$ psi^{-1} $C_w = 3.5 \times 10^{-6}$ psi^{-1}

(b) Calculate the hydrocarbon yield up to bubble point if B_{ob} at bubble point pressure (2750 psia) is 1.350

(c) Project the reservoir performance when following additional reservoir data are available at a reservoir pressure of 1500 psia

B_0= 1.250 z=0.90 T_f=240°F R_{si} 375 SCF/STB

B_{ob}=1.350(at 2750psia) R_{sb}= 500 SCF/STB

$G_p = 3{,}732 \times 10^6$ SCF N_p = 6,436,000 STB

Or

A volumetric gas reservoir has the following production history and following data is also available:

Time, t years	Reservoir pressure, p psia	z	Cumulative production, G_p MMMscf
0.0	1798	0.869	0.00
0.5	1680	0.870	0.96
1.0	1540	0.880	2.12
1.5	1428	0.890	3.21
2.0	1335	0.900	3.92

$\phi = 13\%$
$S_{wi} = 0.52$
$A = 1060$ acres
$h = 54$ ft.
$T = 164°F$

Calculate the gas initially in place volumetrically and from the MBE.

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Question-11

Given Field Data may be used to generate the required information:

(A) Available field data:

Area = 160 acres
Net productive thickness = 40 ft
Initial reservoir pressure = 3250 psia
Porosity = 22%
Connate water = 23%
i) Initial gas FVF = 0.00533 ft^3/SCF
Gas FVF at 2500 psia = 0.00667 ft^3/SCF
ii)Gas FVF at 500 psia = 0.03623 ft^3/SCF
S_{gr} after water invasion = 34%

1. **Initial gas in place ie @3250psia**
2. **Gas in place after volumetric depletion to 2500 psia**
3. **Gas in place after volumetric depletion to 500 psia**
4. **Find the gas recovery at 2500psia**
5. **Find the gas recovery at 500 psia**

(B) **Required information**

1. **Initial gas in place ie @3250psia**
2. **Gas in place after volumetric depletion to 2500 psia**
3. **Gas in place after volumetric depletion to 500 psia**
4. **Find the gas recovery at 2500psia**
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END OF PAPER-1

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SECTION - A

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Question-1

Reserves are defined as ----------

Complete the definition with special reference to the specified definitions of accumulation and economicconditions

Question-2

Describe the stage wise requirements for estimation of in place hydrocarbon reserves at various stages of exploration/exploitation. Also describe the basic features of reserve estimations of all the stages.

Question-3

Complete the following equations:

$$B_g = \frac{p_{sc}}{T_{sc}}\frac{zT}{p} = \boxed{1}\frac{zT}{p} \quad \textbf{and} \quad E_g = \frac{T_{sc}}{p_{sc}}\frac{p}{zT} = \boxed{2}\frac{p}{zT}$$

Question-4

Explain the following abbreviations of oil MBE along with their units & significance:

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Describe MBE of gas reservoir – visualizing it as an idealized gas container with special reference to dry gas.

Section B

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Question-6

Establish the Gas material balance In terms of B_g. Also indicate data requirements for its applicability and restrictions on its application.

Question-7

Discuss main features and preferences of "END POINT" production decline analysis. Also indicated how it can be used for economic millage of a gas reservoir. Also Determine the reserves and estimate in place hydrocarbons in a reservoir having exponential decline and the relation between flow rate(q stb/d) and cumulative production (N_p MSTB) may be giv

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q=0.4301xNp + 5768.7'

The Economic limit of production rate may be taken as -1000 stb/day.

Question-8

(A) Discuss the characteristics of Water drive reservoirs with special reference to the various factors that affect the recovery factors in such reservoirs. Also indicate properties favorable for Gas Recovery.

(B) **Enlist the vital performance parameters of water drive reservoirs**

Question-9

Discuss the role of Reservoir Saturation Equations Discuss their presumptions and state of equilibrium. Also calculate average oil and connate water saturation from the following measurements:

Sample	h_i, ft	ϕ, %	S_{oi}, %	S_{wci}, %
1	1.0	10	75	25
2	1.5	12	77	23
3	1.0	11	79	21
4	2.0	13	74	26
5	2.1	14	78	22
6	1.1	10	75	25

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(b) Also calculate the hydrocarbon yield up to bubble point if B_{ob} at bubble point pressure (2750 psia) is 1.350

(c) Project the reservoir performance when following additional reservoir data are available at a reservoir pressure of 1500 psia

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$S_{wi} = 0.52$
$A = 1060$ acres
$h = 54$ ft.
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Question-11

A gas reservoir has the following characteristics:

A = 3000 acres h = 30 ft Φ= 0.15 S_{wi} = 20% T = 150°F p_i = 2600 psi

p	z
2600	0.82
1000	0.88
400	0.92

Calculate cumulative gas production and recovery factor at 1000 and 400 psi.