Code No: RT32272 **R13** SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, April - 2018

PETROLEUM RESERVOIR ENGINEERING-I

(Petroleum Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A**is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) Define the main categories of hydrocarbon recovery. [3M]
b) Define and derive gas formation volume factor. [4M]
c) What are the types of primary recovery mechanism? [3M]
d) State and explain Darcy's law. [4M]
e) List out the assumptions made for radial cell geometry. [4M]
f) Explain apparent skin factor. [4M]

PART -B

2 a) A volumetric gas reservoir has the following production history. [12M]

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

The following data is also available:

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

Calculate the gas initially in place volumetrically.

b) With the necessary assumptions, Explain the step by step procedure for the gas compressibility equation. [4M]

3 a) Explain the application of PVT parameters to relate surface to reservoir hydrocarbon volumes; below bubble point pressure. [10M]
b) The oil and gas rates, measured at a particular time during the producing life of a reservoir are, x stb oil/day and y scf gas/day. What is the corresponding underground withdrawal rate in reservoir barrels/day? [6M]

4 a) Write down the material balance equation in generalized form. List out the applications of material balance equation in reservoir engineering. [4M]

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b) A combination-drive reservoir contains 10 MMSTB of oil initially in place. The ratio of the original gas-cap volume to the original oil volume, i.e., m, is estimated as 0.25. The initial reservoir pressure is 3000 psia at 150°F. The reservoir produced 1 MMSTB of oil, 1100 MMscf of 0.8 specific gravity gas, and 50,000 STB of water by the time the reservoir pressure dropped to 2800 psi. The following PVT is available: [12M]

	3000 psi	2800 psi
B_o, bbl/STB	1.58	1.48
R_s, scf/STB	1040	850
B_g, bbl/scf	0.00080	0.00092
B_t, bbl/STB	1.58	1.655
B_w, bbl/STB	1.000	1.000

The flowing data also available

$S_{wi} = 0.20$ $c_w = 1.5 \times 10^{-6}\ psi^{-1}$ $c_f = 1 \times 10^{-6}\ psi^{-1}$

Calculate:
i) Cumulative water influx ii) Net water influx iii) Primary driving indexes at 2800 psi.

5 i) What is the conversion factor between k, expressed in Darcies, and in cm^2 and $metre^2$, respectively? [16M]
ii) Convert the full equation for the linear flow of an incompressible fluid, which in Darcy units is

$$q = -\frac{kA}{\mu}\left(\frac{dp}{dl} + \frac{\rho g}{1.0133 \times 10^5}\frac{dz}{dl}\right)$$

To field units.

6 Derive partial differential equation for the radial flow of any single phase fluid in a porous medium. [16M]

7 Derive the radial diffusivity equation of a well under semi steady state condition. [16M]

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