Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: OIL AND GAS RESERVOIR ENGINEERING [CHE 411]

REVISED CREDIT SYSTEM
(30/11/2016)

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A.	What are the primary functions of a reservoir engineering? Which concept(s) you need to aware of to evaluate the primary functions? Explain in detail.	**8**
1B.	What are the applications of the real gas equation of state PV=ZnRT?	**8**
1C.	Explain the retrograde condensation in reservoir with a fluid phase diagram.	**4**
2A.	Derive the expression for productivity index of a reservoir in field units for radial steady state inflow conditions.	**12**
2B.	What is mobility control? How do you achieve the same?	**4**
2C.	Explain the methods of tertiary flooding for enhanced oil recovery.	**4**
3A.	Derive the following basic equation for the radial flow of a fluid in a homogeneous porous medium with a neat schematic. $\frac{1}{r}\frac{\partial}{\partial r}\left(\frac{k\rho}{\mu} r \frac{\partial p}{\partial r}\right) = \phi c \rho \frac{\partial p}{\partial t}$	**10**
3B.	Discuss the semi steady state and steady state conditions of solution for the above radial flow differential equation.	**5**
3C.	Linearize the above basic radial flow equation for fluids of small and constant compressibility by mentioning the assumptions considered.	**5**
4A.	A homogeneous formation in a reservoir has an average effective permeability k_e. The effective permeability out to a radius r_a from the well has been damaged so that its average value in this region is k_a. Show that the skin factor may be expressed as $S = \frac{k_e - k_a}{k_a} \ln \frac{r_a}{r_w}$ where r_w is the wellbore radius. Assume that for $r < r_a$ the flow can be described under steady state conditions and that for $r > r_a$ semi steady state.	**10**

4B. During drilling, a well is damaged out to a radius of 4 ft from the well bore, r_a so that the permeability within the damaged zone, k_a is reduced to $1/100^{th}$ of the undamaged effective permeability, k_e. After completion the well is stimulated so that the permeability out to a distance of 10 ft from the wellbore is increased to ten times the undamaged permeability. What will be the PI ratio increase if the wellbore radius, r_w is 0.333 ft and the drainage radius, r_e is 660 ft? **10**

5A. i) Calculate the density of the gas at standard conditions whose composition is listed below:

Component	Methane	Ethane	Propane	Butane	Pentane	Hexane	CO_2	Nitrogen
mole fraction	0.847	0.0586	0.022	0.0093	0.0052	0.0104	0.013	0.0345

ii) For the above gas what is the pressure gradient in the reservoir at 2000 psia and 180°F (Z = 0.865) **10**

5B. Write the complete PVT analysis of oil. **7**

5C. Define R_s, B_o, B_g parameters. **3**

6A. A gascap reservoir cumulative oil production N_p and cumulative gas oil ratio R_p are listed in below table along with the relevant PVT parameters under the assumption that $p_i = p_b$. The size of the gascap, m and initial oil volume, N are uncertain but based on geological information and volumetric calculations the values are m = 0.4 and N = 115 x 10^6 stb. Are these values confirmed by the production and pressure history? If not, what are the correct values of m and N? **15**

Pressure, psia	3330, $p_i = p_b$	3150	3000	2850	2700	2550	2400
N_p, MMstb		3.295	5.903	8.852	11.503	14.513	17.730
R_p, scf/stb		1050	1060	1160	1235	1265	1300
B_o, rb/stb	1.2511	1.2353	1.2222	1.2122	1.2022	1.1922	1.1822
R_s, scf/stb	510	477	450	425	401	375	352
B_g, rb/scf	.00087	.00092	.00096	.00101	.00107	.00113	.00119

6B. What are investigates that usually carried out for each reservoir drive mechanisms? **5**