Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, APR/MAY 2017

SUBJECT: OIL AND GAS RESERVOIR ENGINEERING [CHE 4002]

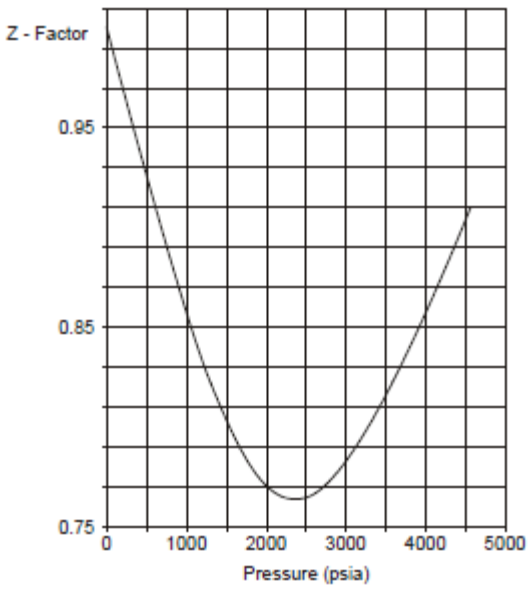
REVISED CREDIT SYSTEM
(27/04/2017)

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1.	The following data are available for a newly discovered gas reservoir: GWC = 9700 ft; Centroid depth = 9537 ft; Net bulk volume (V) = 1.776 X 10^{10} cu.ft; $\Phi = 0.19$; $S_{wc} = 0.20$; $\gamma_g = 0.85$. It is estimated that the water pressure regime in the locality, P_w = 0.441D+31 psia and the temperature gradient is 1.258^{o}F/100 ft, with ambient surface temperature 80^{o}F. A. Calculate the volume of the GIIP. B. It is intended to enter a gas sales contract in which the following points have been stipulated by the purchaser. a) During the first two years, a production rate build-up from zero-100 MMscf/d must be achieved while developing the field. b) The plateau rate must be continued for 15 years at a sales point delivery pressure which corresponds to a minimum reservoir pressure of 1200 psia. Can this latter requirement be fulfilled? (Assume that the aquifer is small). c) Once the market requirement can no longer be satisfied the field rate will decline exponentially by 20% per annum until it is reduced to 20 MMscf/d. What will be the total recovery factor for the reservoir and what is the length of the entire project life?	**20**
2A.	Explain in detail the sampling methods to collet fluid samples from a reservoir. How do you overcome the drawbacks for each method?	**10**
2B.	Describe the application of PVT parameters to relate surface to reservoir hydrocarbon volumes:	



	a) above and b) below bubble point pressure with neat schematics.	**10**
3A.	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	0.00087	0.00092	0.00096	0.00101	0.00107	0.00113	0.00119

3B.	Derive an expression for the free gas saturation in a solution gas drive reservoir at abandonment pressure (below bubble point).	**5**
4A.	Derive the Darcy's law for a fluid flowing through porous medium, which includes dependence of sand and fluid properties.	**10**
4B.	Convert Darcy's law for horizontal, linear flow of an incompressible fluid from Darcy to field units.	**10**
5A.	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**
5B.	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 1/100th 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**

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