Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: OIL & GAS RESERVOIR ENGINEERING [CHE 411]

REVISED CREDIT SYSTEM

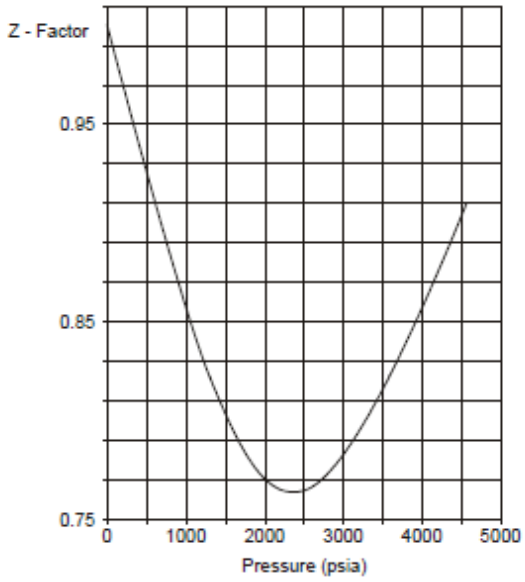
Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable 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; Φ = 0.19; S_{wc} = 0.20; γ_g = 0.85. Estimated water pressure regime is 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.

i) During the first two years, a production rate build-up from zero-100 MMscf/d must be achieved while developing the field.

ii) 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.	Describe the application of PVT parameters to relate surface to reservoir hydrocarbon volumes: a) above and b) below bubble point pressure with a neat schematic.	**8**
2B.	Explain the retrograde condensation in a reservoir with a fluid phase diagram.	**4**
2C.	Write down step by step the complete PVT analysis of oil.	**8**
3A.	Derive the material balance equation for a solution gas driven, unsaturated oil reservoir, where the equation includes effective compressibility term.	**12**
3B.	Determine the fractional oil recovery, during depletion down to bubble point pressure, for the above reservoir whose PVT parameters are listed below and for which c_w = 3 X 10^{-6} /psi; c_f = 8.6 X 10^{-6} /psi; S_{wc} = 0.20. What do you conclude from results?	**8**

p_i = 4000 psi	B_{oi} = 1.2417 rb/stb	p_b = 3330 psi	B_{ob} = 1.2511 rb/stb

4A.	Derive the Darcy's law for fluid flow through porous media which includes the effects of both fluid and porous medium.	**10**
4B.	What is Productivity Index (PI)? Explain the ways to increase the PI in detail.	**10**
5A.	Derive the basic, differential equation for the radial flow of any single phase fluid in a porous medium with neat schematic.	**14**
5B.	Discuss the three conditions of solution for the above radial flow differential equation.	**6**
6A.	Solve the following radial flow diffusivity equation under semi-steady state conditions of a reservoir. $\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial p}{\partial r}\right)=\frac{\phi\mu c}{k}\frac{\partial p}{\partial t}$. Express the solution in terms of average pressure and include the mechanical skin factor.	**10**
6B.	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? The stabilized inflow equation for this case is: $p_e - p_w = \frac{qu}{2\pi k_e h}\left(\ln\frac{r_e}{r_w}-\frac{1}{2}+S\right)$ *where* $S=\frac{k_e-k_a}{k_a}\ln\frac{r_a}{r_w}$	**10**

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