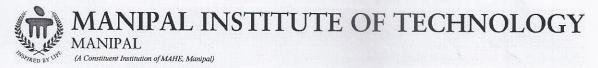
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VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2020

SUBJECT: NATURAL GAS ENGINEERING [CHE 4001]

REVISED CREDIT SYSTEM (30/12/2020 - FN)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions. Read the questions carefully.
- Missing data may be suitably assumed.
- * Refer formulae sheet

1A.	Explain anticlinal structural trap reservoir using rough sketch? Why to study hydrocarbon phase behaviour and explain PT behaviour of the volatile oil type fluid reservoir?							
1B.	A well produces 0.8 specific gravity natural gas; Calculate the compressibility factor 'z' for the following gas composition using Brill-Beggs Method at 140°F and 800 psig							
2A	Write the mechanical energy balance equation for single phase flow along the tubular string and explain terminology used clearly? Explain the Moody friction factor and fanning Friction factor?							
2B.								
2C.						3		
3A.	How to perform the Nodal analysis at the bottomhole node. Write the procedure in detail.					4		
	uctaii.		Explain the well deliverability testing methods in detail with the help of schematics.					

4A.	Derive radial flow basic equation of a single phase, compressible fluid through $1 \partial \left(\partial p \right) \varphi \mu c_{t} \partial p$. State the assumptions			
	porous and permeable rock $\frac{1}{r} \frac{\partial}{\partial r} \left(r \frac{\partial p}{\partial r} \rho \right) = \frac{\varphi \mu c_t}{k} \rho \frac{\partial p}{\partial t}$; State the assumptions			
	used clearly	6		
4B.	Bottom hole pressure: 2200 psia Production rate: 400 stb/day Reservoir pressure: 6100 psia Calculate the productivity index (J)			
5A.	• 1 1:2			
5B.	Explain liquid loading using schematic?			

Formulae Sheet

☑ Pseudocritical Properties

$$P_{pc} = 709.604 - 58.718 \gamma_g$$

$$T_{pc} = 170.491 + 307.344 \gamma_g$$

☑ Compressibility Factor: Brill and Beggs' Correlation Constants

$$A = 1.39(T_{pr} - 0.92)^{0.5} - 0.36T_{pr} - 0.1$$

$$B = (0.62 - 0.23T_{pr})P_{pr} + \left(\frac{0.066}{T_{pr} - 0.86} - 0.037\right)P_{pr}^2 + \frac{0.32P_{pr}^6}{10^{9(T_{pr} - 1)}}$$

$$C = 0.132 - 0.32\log(T_{pr})$$

$$D = 10^{\circ} (0.3106 - 0.49T_{pr} + 0.1824T_{pr}^{2})$$

☑ Pseudosteady state flow IPR for radial flow gas reservoir using pressure square approach and pressure approach

$$q = \frac{kh\left[\overline{p}^2 - p_{wf}^2\right]}{1424\overline{\mu} \,\overline{z} \,T\left[\ln\left(\frac{0.472r_e}{r_w}\right) + s + Dq\right]}$$

$$q = \frac{kh\left[\overline{p} - p_{wf}\right]}{141.2X10^3\overline{B}_g \,\overline{\mu}\left[\ln\left(\frac{0.472r_e}{r_w}\right) + s + Dq\right]}$$

☑ Gas Reservoir Deliverability: Empirical Models (Forchheimer and Backpressure model)

$$\overline{p}^2 - p_{wf}^2 = Aq + Bq^2$$
 $q = C(\overline{p}^2 - p_{wf}^2)^n$

☑ Wellbore Performance: The Average Temperature and Compressibility Factor Method

$$p_{wf}^{2} = Exp(s)p_{hf}^{2} + \frac{6.67X10^{-4}[Exp(s) - 1]fq_{sc}^{2}\overline{z}^{2}\overline{T}^{2}}{d_{i}^{5}\cos\theta} \qquad s = \frac{0.0375\gamma_{g}L\cos\theta}{\overline{z}\overline{T}}$$