

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2024)

CLASS: BTECH
BRANCH: CHEMICAL ENGINEERING

SEMESTER : VII
SESSION : MO/2024

SUBJECT: CL437 NATURAL GAS ENGINEERING

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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|---------|---|-----|-----|---------|
| Q.1(a) | Prove that the compressibility of an ideal gas is equal to inverse of pressure, i.e., $C_g = 1/P$. | [2] | CO1 | BL 3 |
| Q.1(b) | Describe the role of hydraulic fracturing in unconventional natural gas extraction. What are the environmental concerns associated with this technique | [3] | CO1 | 2 |
| Q.2 | Estimate the gas density of a natural gas having a specific gravity (γ_g) 0.65 at 5,000 psia and 180°F. | [5] | CO1 | 3 |
| Q.3 | Describe the term lithography. Explain the main types of the rocks that may contain petroleum hydrocarbon. | [5] | CO2 | 2 |
| Q.4 (a) | Describe the term pay zone thickness for a Reservoir. | [2] | CO2 | 2 |
| Q.4 (b) | An incompressible fluid flows in a linear porous media with the following properties: L = 2000 ft, k = 100 md, p_1 = 2000 psi, h = 20 ft, p_2 = 1990 psi, width = 300 ft, μ = 2 cp. Calculate apparent fluid velocity in ft/day. | [3] | CO2 | 3 |
| Q.5(a) | Why is gas dehydration performed in a gas processing plant after receiving the gas from the wells? | [2] | CO3 | 1 |
| Q.5(b) | Write the name of six utilities that support a gas processing plant. | [3] | CO3 | 1 |

$$A = 1.39(T_{pr} - 0.92)^{0.5} - 0.36T_{pr} - 0.10$$

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

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

$$D = 10^F$$

$$E = 9(T_{pr} - 1)$$

$$F = 0.3106 - 0.49T_{pr} + 0.1824T_{pr}^2$$

$$z = A + \frac{1-A}{e^B} + Cp_{pr}^D$$

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

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

:25/09/2024:M