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PRESIDENCY UNIVERSITY BENGALURU

 SCHOOL OF ENGINEERING

 SUMMER TERM END TERM EXAMINATION - AUGUST 2024

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| **Semester: Summer** | **Date: 07-08-2024** |
| **Course Code: PET215** | **Time: 1:00 PM-4:00 PM** |
| **Course Name: Natural Gas Engineering** | **Max Marks: 100** |
| **Program: B. Tech.**  | **Weightage: 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *The question paper consists of 3 parts.*
3. *Scientific and non-programmable calculators are permitted.*
4. *Do not write any information on the question paper besides Roll Number.*
5. *Use Graph Paper wherever needed. Write the Question No. on the graph paper with a pen.*

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| **PART A** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** |
| 1 | Describe the dehydration of natural gas. | (CO4) | [Knowledge] |
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| 2 | State the different dehydration procedures used in the industry | (CO4) | [Knowledge] |
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| 3 | State the glycols used in dehydrating the natural gas | (CO4) | [Knowledge] |
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| 4 | Define Associated Gas | (CO1) | [Knowledge] |
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| 5 | Describe the phenomena of Liquid loading. | (CO1) | [Knowledge] |
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| 6 | State the two empirical methods used in estimating gas reservoir deliverability. | (CO2) | [Knowledge] |
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| 7 | Define Natural gas. | (CO1) | [Knowledge] |
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| **PART B** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** |
| 8 | Addressing the challenges while drilling and completion of gas reservoirs requires careful planning, advanced technologies, and a comprehensive understanding of geological and reservoir conditions to ensure safe and efficient operations.Explain the problems faced while drilling and completion of the gas reservoirs. | (CO1) | Comprehension |
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| 9 | A gas well produces 0.65 specific gravity natural gas with N2, CO2, and H2S of mole fractions 0.1, 0.08, and 0.02, respectively. The well diameter is 7-7/8 inches. It drains gas from a 78-ft thick pay zone in an area of 160 acres. The average reservoir pressure is 4,613 psia. Reservoir temperature is 180 °F. Assuming a Darcy skin factor of 5 and a non-Darcy coefficient of 0.001 day/Mscf, estimate the deliverability of the gas reservoir under pseudo steady state flow condition at a flowing bottom hole pressure of 3,000 psia. Take k=0.17 mD, z=0.97 and Bg=0.01. | (CO2) | Comprehension |
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| 10 | A gas well produces 0.65 specific gravity natural gas with N2, CO2, and H2S of mole fractions 0.1, 0.08, and 0.02, respectively. The average reservoir pressure is 4,505 psia. Reservoir temperature is 180 °F.Estimate the deliverability of the gas reservoir under flowing bottom hole pressure of 1,050 psia. Use backpressure model with pressure sqared approach. | (CO2) | Comprehension |
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| 11 | Natural gas reserves are essential for addressing energy needs sustainably, reducing environmental impacts, and fostering economic development, making them a vital component of the global energy mix.Briefly explain types of natural gas reserves. Explain with the help of neat diagram. | (CO1) | Comprehension |
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| 12 | Natural gas from the Morgan County, Colorado, D-Sand, has a heating value of 1,228 Btu/scf. If this gas is combusted to drive a gas turbine for a gas compressor of 1,000 hp, what is the required gas flow rate in MMscf/day? Assume that the overall efficiency is 30% (1 hp = 2,544 Btu/h). | (CO1) | Comprehension |
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| 13 | Gas gravity is a fundamental parameter in the oil and gas industry, impacting various aspects of exploration, production, processing, transportation, and regulatory compliance. Its accurate measurement and understanding are essential for efficient and safe operations in this sector. A natural gas consists of the following (molar) composition: C1 = 0.871, C2 = 0.084, C3 = 0.023, CO2 = 0.016 and H2S = 0.006. Predict the gas gravity to air. Standard molecular weight of C1= 16.04, C2=30.07, C3=44.09, CO2=44.01, H2S=34.08. | (CO1) | Comprehension |
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| 14 | Explain the shale gas and Coal bed methane gas in detail. | (CO1) | Comprehension |
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| **PART C** |
|  **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** |
| 15 | For the gas composition given below, compute the apparent molecular weight, pseudocritical pressure and temperature of gas.

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| --- | --- | --- | --- | --- |
| Components | Mole Fractions | Molecular weight | Critical Pressure | Critical Temperature |
| C1 | 0.775 | 16.04 | 673 | 344 |
| C2 | 0.083 | 30.07 | 709 | 550 |
| C3 | 0.021 | 44.10 | 618 | 666 |
| i-C4 | 0.006 | 58.12 | 530 | 733 |
| n-C4 | 0.002 | 58.12 | 551 | 766 |
| i-C5 | 0.003 | 72.15 | 482 | 830 |
| n-C5 | 0.008 | 72.15 | 485 | 847 |
| C6 | 0.001 | 86.18 | 434 | 915 |
| C7+ | 0.001 | 114.23 | 361 | 1024 |
| N2 | 0.050 | 28.02 | 227 | 492 |
| CO2 | 0.030 | 44.01 | 1073 | 548 |
| H2S | 0.020 | 34.08 | 672 | 1306 |

 | (CO1) | [Application] |
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| 16 | State and explain the method of estimating viscosity of natural gas by Carr, Kobayashi, and Burrows (1954) method. | (CO1) | [Application] |
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| 17 | Explain the process of dehydration by Absorption (glycol dehydration system) with flow diagram. | (CO4) | [Application] |
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