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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION - July 2024

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| **Semester : VI** | **Date : 01-07-2024** |
| **Course Code: PET215** | **Time :9:30 AM-12:30 PM** |
| **Course Name: Natural Gas Engineering** | **Max Marks: 100** |
| **Program: B. Tech (Petroleum Engineering)** | **Weightage: 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** | | | |
| 1 | Describe the function of choke devices in production pipelines. | (CO2) | [Knowledge] |
|  | | | |
| 2 | Define Gas specific gravity. | (CO1) | [Knowledge] |
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| 3 | Describe the phenomena of Liquid loading. | (CO5) | [Knowledge] |
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| 4 | State the expression to evaluate Pseudocritical pressure of a gas if total organic content is greater than 7%. | (CO1) | [Knowledge] |
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| 5 | State the different types of glycols used in dehydrating the natural gas | (CO3) | [Knowledge] |
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| 6 | Describe dew point depression in terms of natural gas dehydration system. | (CO3) | [Knowledge] |
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| 7 | State your understanding of the term "Dehydration of Natural Gas". | (CO3) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 8 | The importance of deliverability methods lies in their ability to maximize the economic recovery of natural gas reserves while ensuring sustainable production practices.  State the different methods used in analytical approach in estimating gas reservoir deliverability. Explain the method of selection of analytical approach based on reservoir pressure with a neat diagram. | (CO2) | [Comprehension] |
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| 9 | A 0.65 specific gravity natural gas contains 10% nitrogen, 8% carbon dioxide, and 2% hydrogen sulfide. Compute the Z-factor at 5,000 psia and 180 °F.  Use the BRILL and BREGGS Equation. | (CO1) | [Comprehension] |
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| 10 | Orifice meters are widely used flow measurement devices based on the principle of pressure differential. They play a critical role in monitoring and controlling fluid flow in various industrial processes, providing accurate and reliable measurements for process optimization and control.  Discuss the selection criteria of orifice-meter for natural gas pipelines | (CO4) | [Comprehension] |
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| 11 | Turbine meters and Elbow meters are both valuable tools used in industrial applications for measuring the flow rate of natural gas.  Discuss in detail Turbine meter & Elbow meter | (CO4) | [Comprehension] |
|  | | | |
| 12 | Selection of the appropriate acid gas removal method depends on factors such as the concentration of acid gases in the feed gas, desired purity specifications, flow rates, operating conditions, and economic considerations.  Discuss iron sponge sweetening & alkanol-amine sweetening of natural gases in detail | (CO3) | [Comprehension] |
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| 13 | Glycol/Amine process and the Sulfinol process are effective methods for removing acid gases from natural gas streams. Each process has its advantages and limitations, and proper design and operation are essential for achieving optimal performance.  Discuss Glycol/Amine Process & Sulfinol Process for natural gases in detail. | (CO3) | [Comprehension] |
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| 14 | For the gas composition given below, compute the apparent molecular weight, pseudocritical pressure and temperature of gas.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  |  |  | | 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) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** | | | |
| 15 | State and explain the method of estimating viscosity of natural gas by Carr, Kobayashi, and Burrows (1954) method at high pressure and high temperature with expressions. | (CO1) | [Application] |
|  | | | |
| 16 | Sketch and explain the process of dehydration by Absorption (glycol dehydration system) with flow diagram. Also state the advantages and disadvantages of using dehydration by Absorption process. | (CO3) | [Application] |
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| 17 | A 0.65 specific gravity natural gas flows from a 2-in pipe through a 1.5-in nozzle-type choke. The upstream pressure and temperature are 100 psia and 70 °F, respectively. The downstream pressure is 80 psia (measured 2 ft from the nozzle). The gas-specific heat ratio is 1.25.   1. What is the expected daily flow rate? 2. Is icing a potential problem? | (CO2) | [Application] |
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