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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

MAKE-UP EXAMINATION - JULY 2024

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| **Semester: V** | **Date: 01-07-2024** |
| **Course Code: PET2017** | **Time: 1:30 PM-4:30PM** |
| **Course Name: Natural Gas Hydrates** | **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.*

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| **PART A** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** | | | |
| 1 | Specify the temperature conditions needed for the formation of natural gas hydrates. | (CO 1) | [Knowledge] |
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| 2 | State typical locations where natural gas hydrates can be found. | (CO 1) | [Knowledge] |
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| 3 | Mention two possible uses of natural gas hydrates. | (CO 2) | [Knowledge] |
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| 4 | Explain two risks related to natural gas hydrate exploration. | (CO 3) | [Knowledge] |
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| 5 | Name two techniques used to study natural gas hydrates in the laboratory. | (CO 3) | [Knowledge] |
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| 6 | Give two examples of the environmental impacts of disturbing natural gas hydrates. | (CO 4) | [Knowledge] |
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| 7 | Define the term "clathrate," mentioning suitable temperature and pressure. | (CO 4) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 8 | Discuss the stability conditions for natural gas hydrates and the factors affecting their formation. | (CO 1) | [Comprehension] |
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| 9 | Describe the environmental concerns associated with the extraction of natural gas hydrates. | (CO 1) | [Comprehension] |
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| 10 | Outline the different methods used for exploring natural gas hydrates. | (CO 2) | [Comprehension] |
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| 11 | 1. Given that methane has a molar volume of 22.4 liters at standard temperature and pressure (STP), compute the number of moles of methane in 164 cubic meters. 2. A sediment core sample from a hydrate deposit shows 30% hydrate saturation. If the core sample volume is 0.5 cubic meters, estimate the volume of methane gas that could be released. **5+5=10** | (CO 4) | [Comprehension] |
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| 12 | 1. If an extraction process aims to recover 80% of the methane from a hydrate reservoir containing 200,000 cubic meters of hydrate, what volume of methane can be expected? 2. Calculate the volume of methane gas that can be released from 1 cubic meter of natural gas hydrate, assuming a hydrate-to-gas ratio of 1:164. **6+4=10** | (CO 2) | [Comprehension] |
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| 13 | Discuss the different Gas Hydrate Formation Kinetics Theories with suitable diagrams. | (CO 2) | [Comprehension] |
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| 14 | Compare the potential of natural gas hydrates with traditional fossil fuels in terms of energy density and environmental impact. | (CO 3) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** | | | |
| 15 | Discuss the formation mechanism of natural gas hydrates, including the role of temperature, pressure, and gas composition. | (CO 2) | [Application] |
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| 16 | 1. Calculate the potential energy content of a natural gas hydrate deposit containing 1 million cubic meters of hydrate. Assume the hydrate-to-gas ratio is 1:164 and the energy content of methane is 39.3 MJ/m³. 2. A hydrate reservoir is estimated to contain 20 trillion cubic feet (TCF) of methane. Convert this volume to cubic meters and determine the equivalent hydrate volume, assuming a hydrate-to-gas ratio 1:180. **10+10=20** | (CO 4) | [Application] |
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| 17 | Describe the technological advancements required for efficient and environmentally safe extraction of natural gas hydrates. | (CO 3) | [Application] |
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