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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 04 - 01- 2024 **Time:** 09:30 am – 12:30 pm |

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| **School:** School of Engineering | **Program:** B.Tech - PET | |
| **Course Code:** PET1010 | **Course Name:**  Carbon Capture and Utilization for Sustainability | |
| **Semester**: VII | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **8** | **10** | **40** | **42** | **NA** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Answer ALL the Questions. 10 x 2 Marks=20 Marks** | | | | |
| **1** | Recall the challenge associated with using sorbents in CO₂ capture systems. | **2 Marks** | **L1** | **CO1** |
| **2** | List two potential environmental risks of CCS and discuss their impact on surrounding ecosystems. | **2 Marks** | **L1** | **CO2** |
| **3** | Mention key storage mechanisms used in CO2 sequestration**.** | **2 Marks** | **L1** | **CO1** |
| **4** | Tell the principle on which membranes used in CO₂ capture primarily separate gases. | **2 Marks** | **L1** | **CO2** |
| **5** | List the methods used for capturing CO2 from industrial processes. | **2 Marks** | **L1** | **CO1** |
| **6** | Define afforestation and reforestation and mention their roles in combating climate change. | **2 Marks** | **L1** | **CO4** |
| **7** | Name the primary obstacle to private sector investment in CCS projects in India. | **2 Marks** | **L1** | **CO1** |
| **8** | What are the main byproducts generated in the pre-combustion CO₂ capture process. | **2 Marks** | **L1** | **CO2** |
| **9** | List the types of membrane materials commonly used in large-scale CO₂ capture. | **2 Marks** | **L1** | **CO2** |
| **10** | List the challenge associated with using sorbents in CO₂ capture systems. | **2 Marks** | **L1** | **CO2** |

**Part B**

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| **Answer the Questions Total 80 Marks** | | | | | |
| **11.** | **a.** | Discuss the importance of capacity, injectivity, and containment in the evaluation of CO₂ storage sites. Explain how each factor contributes to ensuring the effectiveness and security of long-term carbon storage | **10**  **Marks** | **L2** | **CO4** |
| **or** | | | | | |
| **12.** | **a.** | Explain the essential measurements used in the appraisal of CO₂ storage sites. Discuss the role of open hole log measurements, acoustic data, and microfrac analysis in site evaluation. | **10**  **Marks** | **L2** | **CO4** |
|  |  |  |  |  |  |
| **13.** | **a.** | Explain the key considerations in injection planning for CO₂ storage. Discuss the factors that influence the optimal injection rates and locations within a storage site**.** | **10**  **Marks** | **L2** | **CO3** |
| **or** | | | | | |
| **14.** | **a.** | Explain the role of monitoring, measurement, and verification (MMV) in ensuring the long-term integrity of CO₂ storage sites. Describe the key direct and indirect measurements used for this purpose. | **10**  **Marks** | **L2** | **CO3** |

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| **15.** | **a.** | Discuss the role of saline aquifers in geological CO₂ storage and evaluate their advantages over other types of geological formations. | **10**  **Marks** | **L3** | **CO4** |
| **Or** | | | | | |
| **16.** | **a.** | Discuss the advantages and disadvantages of geological and ocean storage for CO₂ sequestration. Highlight how these methods contribute to climate change mitigation and the potential environmental risks associated with their implementation | **10**  **Marks** | **L3** | **CO4** |

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| **17.** | **a.** | Demonstrate the feasibility of pipeline transport versus ship transport for CO₂ in offshore Enhanced Oil Recovery (EOR) projects. Include safety, cost, and scalability in your analysis. | **15**  **Marks** | **L3** | **CO3** |
| **Or** | | | | | |
| **18.** | **a.** | Develop an integrated plan for implementing Carbon Capture, Utilization, and Storage (CCUS) in a mature oilfield. Include steps for CO₂ capture, transportation, and utilization in EOR, ensuring low-emission operations. | **15**  **Marks** | **L3** | **CO3** |

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| **19.** | **a.** | Discuss how CO₂ contributes to reducing emissions in petroleum production, with an emphasis on renewable energy integration, flared gas utilization, and hybrid techniques | **15**  **Marks** | **L2** | **CO3** |
| **Or** | | | | | |
| **20.** | **a.** | Discuss the role of electrification of operations and renewable energy in reducing emissions during petroleum production. Highlight how digitalization, remote monitoring, and hydrogen integration contribute to achieving carbon-neutral drilling and production**.** | **15**  **Marks** | **L2** | **CO3** |

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| **21.** | **a.** | Demonstrate the process of screening and ranking ideal CO₂ storage sites by analyzing technical, commercial, and environmental site performance. Discuss the significance of non-technical factors such as data availability, transportation, monitoring, and permitting in site selection**.** | **20**  **Marks** | **L3** | **CO4** |
| **Or** | | | | | |
| **22.** | **a.** | Examine the major challenges associated with implementing future CO₂ management strategies, including technological, economic, and regulatory barriers. Discuss future techniques and suggest potential solutions to overcome these challenges and accelerate adoption. | **20**  **Marks** | **L3** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***