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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **Ph.D. Course Work End Term Examinations – JAN-FEB 2025** |
| **Date:** 31- 01- 2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** Ph.D.  |
| **Course Code:** PET802 | **Course Name:** Sustainable Materials for Drilling Fluid Management |
| **Semester**:  | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **10** | **30** | **20** | **40** | **-** |

**Instructions:**

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

**Part A**

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| **Answer ALL the Questions. Each question carries 10 marks. 6Q x 10M=60Marks** |
| **1** | Provide an overview of the classification of polymers based on their origin, structure, and molecular forces. Discuss the characteristics of each category, and illustrate with examples for better understanding. | **10 Marks** | **L3** | **CO1** |
| **2** | Explain the principle behind X-ray diffraction (XRD), its significance in material science, and how Bragg's Law is utilized to determine crystal structures. | **10 Marks** | **L3** | **CO2** |
| **3** | Explain the differences in dimensional characteristics and properties of 3D, 2D, 1D, and 0D nanomaterials. | **10 Marks** | **L3** | **CO3** |
| **4** | How do homogeneous and heterogeneous polymerization systems differ in terms of principles, processes, advantages, and limitations? | **10 Marks** | **L3** | **CO3** |
| **5** | Compare the top-down and bottom-up approaches for nanomaterial synthesis, focusing on their principles, processes, advantages, and limitations. | **10 Marks** | **L2** | **CO4** |
| **6** | Write a short not on: FTIR, NMR, and UV-Vis spectroscopy in polymer analysis. | **10 Marks** | **L2** | **CO4** |

**Part B**

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| **Answer the Questions. Each question carries 20 marks 2Q x 20 = 40 Marks** |
| **7.** |  | Provide a comprehensive evaluation of the solvothermal synthesis method used for the production of metal nanocrystals. Begin by discussing the fundamental principles behind this technique, particularly the reduction processes involved in the formation of nanocrystals. Delve into the critical parameters that significantly impact the synthesis, such as temperature, pressure, the choice of solvents, and the type of reducing agents used. Analyze the advantages of solvothermal synthesis, including its ability to control particle size and shape, while also considering the limitations, such as potential challenges in scalability and material purity. To further illustrate the method's effectiveness and applicability, provide specific examples of metal nanocrystals synthesized using solvothermal methods, highlighting their potential uses and importance in various fields. | **20 Marks** | **L4** | **CO2** |
|  |
| **8.** |  | Discuss the various methods used to evaluate the tensile strength of polymers, covering both physical testing techniques and thermal analysis approaches. Begin by providing a detailed explanation of the principles behind each method, such as tensile testing, dynamic mechanical analysis (DMA), and thermal gravimetric analysis (TGA). Describe the processes involved in performing these tests, including the preparation of polymer samples, the specific conditions under which tests are conducted, and the types of data obtained from each method. Emphasize the significance of each technique in polymer characterization, focusing on how they help assess the material's mechanical properties, stability, and performance under different conditions. Furthermore, compare the advantages and limitations of these various methods, addressing factors such as accuracy, ease of use, applicability to different polymer types, and cost-effectiveness. Provide insights into which techniques are most suitable for particular types of polymers and specific applications, illustrating how they contribute to the understanding and improvement of polymer materials. | **20 Marks** | **L4** | **CO4** |

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