# K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

| WINTER-2025 | |
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| Exam Seat No.: | |
| Academic Year: 2025-2026 | Semester: VII |
| Class: FINAL | Program: B.Tech |
| Branch Code: CHE | Pattern: 2022 |
| Name of Course: Green Technology | Course Code: CHE224005B |
| Max. Marks: 60 | Duration: 2.30 Hrs. |

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome of the Question/sub-question.

| | | Marks | CO |
|---|---|---|---|
| **Question No. 1** | | | |
| 1a) | Are Sustainable development and green chemistry the same? Explain if a difference exists between them. | (6) | CO1 |
| **Question No. 2** | | | |
| 2a) | A chemical plant generates a significant amount of spent catalyst as solid waste. Propose two specific strategies, based on waste minimization principles, to reduce the disposal of this spent catalyst. | (6) | CO2 |
| **Question No. 3** | | | |
| 3a) | Define the term "eutectic mixture." Explain the reason behind the significantly depressed melting point of a Deep Eutectic Solvent (DES) like Choline Chloride-Urea. | (8) | CO1 |
| | **OR** | | |
| 3b) | Describe the function of a Phase Transfer Catalyst (PTC) in a reaction where one reactant is in an aqueous phase and another is in an organic phase. | (8) | CO1 |
| 3c) | How does achieving a high "Atom Economy" in a chemical synthesis align with and promote the goals of Green Chemistry? | (8) | CO3 |
| | **OR** | | |
| 3d) | Elaborate on two key advantages that Supercritical $CO_2$ ($scCO_2$) possesses over traditional organic solvents like dichloromethane for extraction purposes. | (8) | CO1 |
| **Question No. 4** | | | |
| 4a) | Discuss one major advantage and one potential drawback of employing a microreactor for a rapid, highly exothermic chemical reaction. | (8) | CO1 |
| | **OR** | | |

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| 4b) | Although water is an ideal green solvent, it is ineffective for non-polar compounds. Propose and explain one strategy to run a reaction involving hydrophobic reactants in an aqueous medium. | (8) | CO1 |
| 4c) | Using a catalyst can often replace a stoichiometric reagent. Analyze how this substitution contributes to a lower E-factor for the manufacturing process. | (8) | CO3 |

**OR**

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| 4d) | Identify one critical safety aspect that becomes more prominent in an intensified, continuous microreactor system when compared to a large-scale batch reactor. | (8) | CO1 |

**Question No. 5**

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| 5a) | Using the case study of Green Ammonia, explain how a bio-refinery concept moves beyond simple biomass conversion to create an integrated, circular ecosystem. | (8) | CO1 |

**OR**

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| 5b) | Compare the cradle-to-gate environmental impact of Green Polyethylene (bio-PE) with its conventional counterpart, focusing on the key metric of carbon footprint. | (8) | CO1 |
| 5c) | The production of Green PVC presents a unique technical challenge compared to Green Polyethylene. Identify this challenge and propose a viable pathway to overcome it. | (8) | CO1 |

**OR**

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| 5d) | How do Fuel Cells represent a more efficient technology for energy conversion compared to internal combustion engines, particularly in the context of utilizing Green Hydrogen? | (8) | CO3 |

**····· End of question paper·····**