

Degree: B. Tech. Semester: SECOND  
END-SEMESTER EXAMINATION, APRIL-MAY 2025

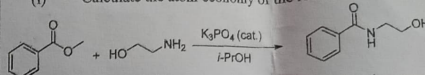
Course Title: Environmental Science and Green Chemistry  
Course Code: FCCH0103

Duration: 03 Hours

Max. Marks: 50

Note: - Attempt all questions in the given order only. Missing data/information (if any), may be suitably assumed & mentioned in the answer.

| Q. No.                  | Questions   | Marks    | CO        |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
|-------------------------|---|----------|-----------|------------------------|----------------|----------------------|----------------------|-------------------|-----------------|--------------------|---------------------------|-------------------------|-------------------|--|--|
| Q 1                     | Attempt any 2 parts of the following  |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 1a                      | Match the terms of column I with appropriate terms of column II   | 5        | 1         |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
|                         | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Column I</th> <th style="width: 50%;">Column II</th> </tr> </thead> <tbody> <tr> <td>1. Fossil fuel burning</td> <td>Microorganisms</td> </tr> <tr> <td>2. Non-point sources</td> <td>Peroxyacetyl nitrate</td> </tr> <tr> <td>3. Bioremediators</td> <td>Somatic effects</td> </tr> <tr> <td>4. Nuclear hazards</td> <td>Rain water sweeping roads</td> </tr> <tr> <td>5. Secondary Pollutants</td> <td>Benzo- (a) pyrene</td> </tr> </tbody> </table> | Column I | Column II | 1. Fossil fuel burning | Microorganisms | 2. Non-point sources | Peroxyacetyl nitrate | 3. Bioremediators | Somatic effects | 4. Nuclear hazards | Rain water sweeping roads | 5. Secondary Pollutants | Benzo- (a) pyrene |  |  |
| Column I                | Column II   |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 1. Fossil fuel burning  | Microorganisms  |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 2. Non-point sources    | Peroxyacetyl nitrate  |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 3. Bioremediators       | Somatic effects   |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 4. Nuclear hazards      | Rain water sweeping roads   |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 5. Secondary Pollutants | Benzo- (a) pyrene   |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 1b                      | Fill in the blanks.<br>(a) Radioactive pollutants: include ----- and -----.<br>(b) Conditions that are unfavourable for bioremediation may be improved by adding "amendments" to the environment such as ----- and -----.<br>(c) Common e-waste disposal methods are ----- and -----.<br>(d) Example of point sources are ----- and -----.<br>(e) The methods of solid-waste disposal are ----- and -----.  | 5        | 1         |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 1c                      | Define bioremediation according to Environmental Protection Act. Mention at least 4 advantages and disadvantages of bioremediation.   | 1 + 4    | 1         |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| Q 2                     | Attempt any 2 parts of the following  |          |           |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 2a                      | A water sample has the following analysis:<br>Mg (HCO <sub>3</sub> ) <sub>2</sub> = 85.0 mg/L; Ca (HCO <sub>3</sub> ) <sub>2</sub> = 130 mg/L; CaSO <sub>4</sub> = 120 mg/L;<br>MgCl <sub>2</sub> = 80 mg/L; CaCl <sub>2</sub> = 90.0 mg/L; KCl = 45 mg/L. Calculate the temporary and permanent hardness in degree Clark.  | 5        | 2         |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 2b                      | 100 mL of a water sample required 12.4 mL of N/10 H <sub>2</sub> SO <sub>4</sub> for neutralization to phenolphthalein end point. After this methyl orange indicator was added to this and further volume of acid required was 15.2 mL. Mention the ions responsible for alkalinity and calculate their concentration in terms of ppm.  | 5        | 2         |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |
| 2c                      | Name the ions responsible for the following cases of Phenolphthalein (P) and Methyl Orange alkalinity and also write the corresponding formulas for alkalinity in terms of P and M.   | 5        | 2         |                        |                |                      |                      |                   |                 |                    |                           |                         |                   |  |  |

|     |   |             |   |
|-----|---|-------------|---|
|     | (1) P = 0<br>(2) P > M/2<br>(3) P < M/2<br>(4) P = M/2<br>(5) P = M   |             |   |
| Q 3 | Attempt any 2 parts of the following  |             |   |
| 3a  | (i) Calculate the atom economy of the reaction.<br><br>(ii) Define the term E-Factor, how it is related to the waste?   | 3+2         | 3 |
| 3b  | (i) Give the reactions involved in the synthesis of biodiesel.<br>(ii) Mention at least 2 drawbacks of stoichiometric reagent over catalytic reactions. Justify your answers with the reactions.  | 3 + 2       | 3 |
| 3c  | (i) How does conventional heating differ from microwave heating? Mention at least 3 points of differences.<br>(ii) Answer the following:<br>(a) Name the biocatalyst used in the synthesis of catechol.<br>(b) Name the biodegradable plastic that could be a substitute for petrochemical-based plastics.<br>(c) Name the eco-friendly and non-toxic paint.<br>(d) Name the effective agent for getting clear water from turbid water. | 3 + 2       | 3 |
| Q 4 | Attempt any 2 parts of the following  |             |   |
| 4a  | (i) Write the synthesis of Lactic acid leading to the formation of racemic mixture.<br>(ii) How is Poly lactic acid (PLA) synthesized from lactic acid through lactide ring formation. Write the reactions involved.  | 2.5<br>2.5  | 4 |
| 4b  | (i) Write the reaction involved in the synthesis of Polyvinyl alcohol (PVA).<br>(ii) Why the synthesis of PVA cannot be achieved through corresponding monomer. Justify your answer with reasons<br>(iii) Discuss at least 2 applications of PVA.   | 2<br>2<br>1 | 4 |
| 4c  | (i) Why is blue hydrogen considered better alternative to grey hydrogen.<br>(ii) What are the possible reactions involved in the formation of green hydrogen through photocatalytic process.  | 2 + 3       | 4 |
| Q 5 | Attempt any 2 parts of the following  |             |   |
| 5a  | (i) A solution with a concentration of 0.18 M is measured to have an absorbance of 0.5. Another solution measured under the same conditions has an absorbance of 0.35. What is the concentration?<br>(ii) Among 1,3-hexadiene and 1,4-hexadiene, which molecule will absorb at a long wavelength? Justify your answer with reason.  | 3 + 2       | 5 |
| 5b  | (i) Define R <sub>f</sub> value?<br>(ii) Identify chromophores and auxochromes in the following molecules:<br>(a) Ethene<br>(B) Aniline   | 1<br>2      | 5 |

|    |   |       |   |
|----|---|-------|---|
|    | <p>(C) Phenol<br/>(D) Nitrobenzene</p> <p>(iii) A sample has 5 components: 1, 2, 3, 4 and 5. The order of the interactions of the components with the mobile phase is as follows: <math>1 &gt; 4 &gt; 3 &gt; 2 &gt; 5</math>. Which component will separate out at first and last during chromatography. Justify your answer with reason.</p> | 2     |   |
| 5c | <p>(i) How do the nature of solvent and dimensions of the column affect the efficiency of the process in column chromatography.</p> <p>(ii) In adsorption chromatography, out of acetic acid and ethanol, which will adsorbed more strongly on stationary phase. Justify your answer with reason.</p>   | 4 + 1 | 5 |