# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

## II SEMESTER M.TECH (INDUSTRIAL BIOTECHNOLOGY)

## END-SEMESTER EXAMINATION

## Open Elective: Introduction to Biofuels and Biopolymers (BIO 5301)

**ANSWER ALL QUESTIONS**

**Date: 09.05.2024** **Time: 9.30 am to 12.30 pm** **Max. Marks: 50**

| Q. NO | QUESTION | Marks | CO | PO | BTL |
|---|---|---|---|---|---|
| 1A | Differentiate between a petroleum refinery from a biorefinery in terms of net emission of greenhouse gas(es). | 2 | 1 | 1 | 2 |
| 1B | Comment on "sustainability" using the following facts: The $Y_E$ for biodiesel from soybean oil is 3.2 compared to 1.5 for ethanol from corn. For petroleum diesel & gasoline, $Y_E$ is 0.84 & 0.81, respectively. | 3 | 1 | 1 | 3 |
| 1C | With the help of suitable examples, cite the types of polymerization reactions used to formulate new synthetic polymers. | 5 | 3 | 4 | 2 |
| 2A | A start-up company claims that they have disposable plates and cups that are completely biodegradable and compostable. How would you put the articles to test the biodegradability, before giving approval for their sale in the market? | 3 | 3 | 4 | 4 |
| 2B | State any two bioplastic properties of polyhydroxyalkanoates/butyrates. How does PHA degrade under aerobic and anaerobic conditions? | 3 | 3 | 4 | 2 |
| 2C | You have formulated a new biofuel, derived from a novel agricultural feedstock. What are the categories of environmental impact that one would get to interpret from the life cycle analysis of this biofuel? | 4 | 1 | 1 | 3 |
| 3A | Which is the most common microorganism used for the fermentation step of bioethanol production? What are the sugars that it can and cannot uptake during fermentation? | 2 | 2 | 4 | 3 |

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| **3B** | You have been given a stock of lignocellulosic biomass to be used as feedstock to produce bioethanol. Alongside, if you were provided the requisite volume of dilute sulphuric acid, what would you do with the acid and how? | **3** | **2** | **4** | **4** |
| **3C** | Outline the major steps involved in the processing of natural rubber. | **5** | **3** | **4** | **2** |
| **4A** | How does a polylactic acid-based biopolymer degrade, with time? | **2** | **4** | **1** | **3** |
| **4B** | What do you understand from the polydispersity index? You have developed a new biopolymer in the lab. What would be its PDI? | **3** | **4** | **1** | **3** |
| **4C** | You are working in a dairy plant. If the effluent from the plant is to be used to produce biogas, how would you proceed. Present the operational steps along with a detailed flowsheet. | **5** | **2** | **4** | **3** |
| **5A** | Why do you think cetane numbers are a significant property of fuels? Show the graphical correlation between ignition delay and the cetane number. | **3** | **2** | **4** | **2** |
| **5B** | When you are researching new feedstocks to produce biodiesel, you happen to discover a new source. However, upon testing the oil, the analysis shows a high phospholipid content. Why is this a serious concern and what would you do to sort out this problem? | **3** | **2** | **4** | **4** |
| **5C** | What may be used as a starting material for the manufacture of polylactide as a biopolymer? State the mechanism of reaction behind the same. | **4** | **3** | **4** | **2** |
| | **CO: Course Outcome; BLOOM TAXONOMY LEVEL: 1-Remember, 2-Understand, 3-Apply, 4-Analyze, 5-Evaluate, 6-Create** | | | | |