



**Part-B OPEN BOOK**

**Important  
Instructions**

- There are **THREE** questions printed in the question paper
- Answer all questions in the provided answer booklet only
- **DO NOT** use pencils for answering any part
- Start answering each question from a fresh page, all sub-sections together

**Q.1.(a)** It is known fact that achieving the environmental sustainability is necessitated by CO<sub>2</sub>-management. Describe how catalysis plays the pivotal role in every option for CO<sub>2</sub>-management. [3M]

**(b)** Is sustainable chemistry different from green chemistry? Justify your answer in two points. [1M]

**(c)** (i) What are the different biorefinery concepts based on? State a difference between the two concepts;  
(ii) Mention the strategies for utilization of biomass as feedstock under a modern biorefinery concept;  
(iii) How is 'aqueous phase reforming' different than 'Ecorefining'? [2+1+2=5M]

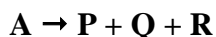
**(d)** Cite one example each for use of biomass-based platforms for applications in perfumery industry, biodegradable polymer, lubricant additives [3M]

**Q.2.(a)** Describe one elementary step of homogeneous catalysis that is typically (i) not participated by, (ii) participated by a d<sup>0</sup> or d<sup>1</sup> transition metal species as catalyst. [2M]

**(b)** Describe in brief the common mechanistic models used in heterogeneous catalysis. [2M]

**(c)** Explain the shape-selectivity manifested by zeolites phenomenologically. [3M]

**(d)** A catalyst C catalyzes a reaction with reactant A to main product P as,



Substrate (A), moles	Catalyst, mole %	Time, h	P, moles	Q, moles	R, moles
8	0.02	2	7.15	0.03	0.02

Calculate (i) TON, (ii) TOF, (iii) Selectivity to P, (iv) Conversion assuming 100 % mass balance. [4M]

**Q.3.(a)** Describe the process routes for the synthesis of green diesel. [4M]

**(b)** Describe any two classes of biomass-derived surfactant products with respect to their synthesis and applications. [4M]

**(c)(i)** Raw biomass and pyrolysis oil are much less efficient (in terms of heating value) while char is almost double the value – Explain. (ii) What are anhydro-sugars? How are they formed from biomass? [2+2=4M]

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