INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Mid-Autumn Semester Examination, 2024-25

***Subject*: Petrochemical Technology** ***Subject No.*: CH62010**

***Date*: 19.09.2024 (AN)** ***Time*: 2 Hrs.** ***Full Marks*: 30**

Instruction: Answer ALL Questions

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1. **Match the raw materials in *Group I* with the processes in *Group II* and products in *Group III*:** [5]

Group I	*Group II*	*Group III*
'Syngas'	Lurgi	Acrylonitrile
Propylene	Sorbex™	Propylene
Naphtha	Oxo	n-Butyraldehyde
Methanol	Sohio	Methanol
	ICI	n-Paraffins

2. (a) What are the common impurities of feedstocks used for the production of petrochemicals?
(b) Discuss the importance of refinery off-gas as a feedstock for petrochemicals. [2+3]

3. (a) Discuss the process of autothermal reforming of natural gas for the production of 'Syngas'.
(b) Give a list of chemicals and fuels that could be produced from 'Syngas'. [3+2]

4. Discuss with a neat flow sheet the process of production of olefins from naphtha by MaxEne process. [5]

5. (a) Discuss with a neat flow sheet the balanced chlorination-oxychlorination process for the production vinyl chloride monomer (VCM) from ethylene.
(b) With a suitable flow sheet, develop a balanced process for the production of VCM from a feedstock containing equimolar mixture of ethylene and acetylene. [3+2]

6. (a) Discuss with a suitable flow sheet the 'LP Oxo℠' process for the production of n-butanol from propylene. Mention clearly the catalyst system and the process conditions that are used to get more than 95% selectivity for the normal isomer.
(b) Give a list of other important chemicals that are produced from propylene. [4+1]

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INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

End-Autumn Semester Examination, 2024-2025

Subject: Petrochemical Technology *Subject No.*: CH62010

Date: 20.11.2024 (AN) *Time*: 3 Hrs *Full Marks*: 50

Instruction : Answer *ANY FIVE* Questions

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1. (a) Match the raw materials in Group I with the products in Group II:

Group I	Group II
m-Xylene	Terephthalic acid
Isopropyl toluene	Phthalic anhydride
p-Xylene	Isophthalic acid
o-Xylene	Cresol

(b) Match the products in Group I with the catalysts used for their production in Group II:

Group I	Group II
Ethylene oxide	$Bi_2(MoO_4)_3$
Adipic acid	$MnBr_2$
Acrolein	Ag_2O
Terephthalic acid	Co-Naphthenate

(c) Match the chemicals in Group I with their functions in Group II:

Group I	Group II
Dioctyl phthalate	Monomer
TAME	Solvent
Isoprene	Plasticizer
Diethanolamine	Fuel Oxygenate

(d) Match the raw materials in *Group I* with the processes in *Group II* and products in *Group III*:

Group I	*Group II*	*Group III*
Propylene	Transalkylation	1-Butene
C_4 Olefins	Alkylation	Acrylonitrile
Diisopropyl benzene	Ammoxidation	MTBE
Isobutene	Sorbutene	Cumene

[2+2+2+4]

2. With comprehensive product flow diagrams, discuss the operation of a natural gas based petrochemical complex.

[10]

3. With a neat flow sheet, discuss the process of production of aromatic building blocks from heavy naphtha clearly mentioning various steps involved in the process.

[10]

4. **(a)** Benzene is an important feedstock for the production of several petrochemicals. Give a list of petrochemicals, with reaction scheme, that could be obtained from benzene as the starting material.
(b) Describe with a suitable flow sheet the 'Q-Max™' process for the production of cumene. **[5+5]**

5. Discuss various processes available to get *p*-xylene from toluene. How can you integrate these processes in an aromatic complex to produce maximum *p*-xylene? Discuss with suitable flow sheets for individual as well as integrated processes. **[10]**

6. **(a)** What are the major uses of phthalic anhydride?
(b) Discuss with a suitable flow sheet the process of production of phthalic anhydride from *o*-xylene. **[2+8]**

7. **(a)** What are the impurities of crude terephthalic acid (TPA) obtained by oxidation of *p*-xylene?
(b) Discuss with a flow sheet the typical purification process practiced in industry to get polymer-grade purified terephthalic acid (PTA) from TPA. **[2+8]**

8. Write short notes on: **[5+5]**
(a) Pacol process (UOP) for the production of linear alkyl benzene (LAB)
(b) Production of butadiene from naphtha cracker C_4-stream

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