

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (30) MODERN PETROCHEMICAL TECHNOLOGY SUBJECT CODE: 2713012 SEMESTER: I

Type of course: Chemical Engineering (ELECTIVE I)

Prerequisite: Basic of Organic Chemistry and General Chemical Technology

Rationale: Petrochemical products are widely used in all forms of human life and industries hence In depth knowledge of various synthesis materials for petrochemicals is mandatory. The specialized knowledge of Petrochemicals fields with various operating conditions, Technology licensors, Process flow diagrams, Major Engineering Problems etc. are mandatory for a post graduate student of Chemical Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2	2	5	70	30	20	10	20	0	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction: Global status of petrochemicals, Assessment of petrochemical feed-stocks, Technology trends, Petrochemical scenario in India. Survey of unit processes as applied to production of petrochemicals with emphasis on reaction mechanism, catalysts, solvents, reactors, operating conditions etc.	4	8
2	Synthesis gas/ Natural gas based petrochemicals (C₁ Petrochemicals): Steam reforming, production of hydrogen, synthesis involving Carbon Monoxide, Fischer Tropsch synthesis, Oxo synthesis.	7	42
3	Production of Olefins: Hydrocarbon pyrolysis kinetics and mechanisms Naptha cracking, Gas cracking, Furnace and other components, separation of Ethylene, Propylene, C ₄ olefins and diolefins, C ₅ olefins and diolefins.	8	
4	Olefin Derivatives: Ethylene based chemicals: Olefin metathesis etc. Propylene based chemicals: Production of polypropylene, Acrylic acid, Acrylonitrile, PMMA, Cumene etc. C₄ based chemicals: MTBE(catalytic distillation), t-Butyl alcohol, butadiene etc.	8	
5	Aromatics production: Isolation of aromatics, separation of C ₈ aromatics. Benzene derivatives: Production of Ethylbenzene, Styrene, LAB, Maleic anhydride, Cyclohexane, Caprolactum, Bisphenol A etc. Xylene derivatives: Production of Phthalic anhydride, Terephthalic	10	37

	acid, Dimethyl terephthalate.		
6	Properties, application and production technologies of the following polymers: ABS plastics, nylon-6, polycarbonate, epoxy resin, unsaturated resin, rubber, LLDPE, PET, Polyamides, Methyl methacrylate.	10	
7	Miscellaneous aspects of petrochemical production: Safety and Health aspects Environmental aspects Clean Technologies Future beyond petroleum Challenges faced by Petrochemical Industry	7	11

Reference Books:

1. P.Desikan and T.C Sivakumar, "Unit processes in Organic Chemical Industries", IIT Madras, 1982
2. E.C.Leonard, "Vinyl and Diene Monomers", Wiley 1969.
3. H.G. Franck & J.W. Stadelhofer, "Industrial Aromatic Chemistry", Springer Verlag, 1988.
4. Sami Matar & Lewis F. Hatch, "Chemistry of Petrochemical Process". 2nd Edition, Gulf Publishing Company, Houston, Texas, 2000

Course Outcome:

After learning the course the students should be able to:

1. Understand the global and Indian scenario of petrochemical industries.
2. They have knowledge of synthesis of widely used finished petrochemicals, aromatic compounds, polymer compounds etc.
3. They have understanding of Safety, health and environmental aspects of various production facilities, future prospects and challenges of petrochemical complexes.

List of Experiments :

Laboratory scale manufacturing or testing of important properties of any five petrochemicals

Open Ended Problems:

The practical work at masters must be largely consisting of OEP. In each case a sample set may be provided and the faculty member may be empowered to select appropriate problems for practical work. At the end of semester before submission of marks of PA and term work, the faculty member will upload the three best problems done by the students during the practical hours. The title area of project with practical problem along with the complete details and names of the students and name of the supervisor, branch and name of the college be specified so that this information can be published from GTU website.

Open Ended Problems for Modern Petrochemical Technology may include:

- Exhaustive literature survey and Poster/ Project presentation of global/ Indian scenario of petrochemical industries.
- Laboratory scale manufacturing such as rubber, plastics etc.
- 3-D models of plant layouts of renowned Petrochemical Complexes.
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Major Equipments:

Equipments required for manufacturing and/or testing of petrochemicals as mentioned above.

List of Open Source Software/learning website:

- NPTEL Lecture series.

- Literature available for petrochemicals.
- MIT open course lecture on petrochemicals.