



Gyanmanjari
Innovative University

Course Syllabus

Gyanmanjari Institute of Technology

Semester-6 (B.Tech)

Subject: Petroleum Refining and Petrochemicals- BETCH16322

Type of course: Minor Stream

Prerequisite: Basics of Chemical Technologies

Rationale: The petrochemical and petroleum refining sectors make up a significant portion of the chemical sector. The vast use of petroleum products, their variety, and their expanding applications are unavoidable challenges for every chemical engineer. Chemical engineers must utilize the pertinent ideas for operating a petrochemical plant or petroleum refinery safely. Additionally, a chemical engineer has to understand the different characteristics of petrochemicals and petroleum fractions. Thus, the purpose of this course is to cultivate such knowledge and abilities.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	150
				ESE	MSE	V	P	ALA	
3	0	0	3	60	30	10	0	50	

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE – End Semester Examination; MSE- Mid Semester Examination; CA - Continuous Assessment; ALA-Active Learning Activities.



Course Content:

Sr. No	Course content	Hrs	% Weightage
1	Properties of Petroleum Products: Basics of petroleum refinery Types of Gases and their Composition, Types of Gasoline & it's Important Properties and Tests such as ASTM Distillation, RVP, Octane number , Oxidation stability , Sulphur Content etc., Various types of Naphtha and their Important Properties and Application, Important tests and Properties of Kerosene such as Flash & Fire Point , Smoke Point , Aniline Point etc., Types of Diesel & its Important Properties and Tests such as Pour Point, Diesel Index ,Cetane Number etc. , Heavy Fractions Like Lube Oil, Bitumen ,Asphalt etc. and their Important Properties Such as Viscosity Index, Carbon Residue, Penetration Index, Softening Point etc.	12	20
2	Processing of Petroleum: Pretreatment of Crude (Dehydration & Desalting), Pumping of Waxy Crude, Heating of Crude, Distillation of Petroleum & Types of Refluxes, ADU & VDU etc.	12	20
3	Treatment Techniques: Physical Impurities Found in Crude & their Removal, Sweetening Techniques, Production and Treatment of LPG, Gasoline Treatment Such as Lead Doctoring, Merox Sweetening, Catalytic Desulphurization etc. Various Methods of Treatment of Lubes Such as Phenol Extraction, Furfural Extraction, etc..	12	20
4	Thermal & Catalytic Cracking: Necessity and types of cracking Thermal cracking: Mechanism of Thermal Cracking, Properties of Cracked Materials, Visbreaking, Dubb's Two Coil Process, Delayed Coking, Naphtha Cracking etc. Catalytic cracking: Advantages & Theory of Catalytic Cracking, Fixed Bed, Moving Bed & Fluidized Bed Technology, FCC, Hydrocracking, Catalytic Reforming, Platforming, Continuous Catalyst Regeneration Reforming, Catalytic Polymerization, Catalytic Alkylation, Catalytic Isomerization etc.	12	20



5	PETROCHEMICALS: C1 and C2 Petrochemicals: Methanol, Formaldehyde, Chlorome thane etc. Ethylene, Ethylene Dichloride, Vinyl Chloride, Ethylene Oxide, Ethylene Glycol, Ethanol amines etc. C3, C4, Aromatics and Polymers: Propylene, Butadiene, etc. BTX Separation, p-xylene, Styrene, p-terephthalic acid, etc. PVC, LDPE, LLDPE, HDPE, Polypropylene, Polypropylene Co-polymers, Polystyrene, SBR, PBR, Polyesters etc.	12	20
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Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	Flash and Fire point: Students will identify different petroleum products and list out flash and fire point of that products and upload pdf on GMIU Web Portal.	10
2	Solvent Extraction: Students will prepare a flow diagram of solvent extraction (Phenol/Furfural extraction) and explain why solvent is selected. Upload the PDF to the GMIU Web Portal.	10
3	Properties of Diesel: Students will list important diesel properties (Flash point, Pour point, Cloud point, Cetane number, Density, Sulphur content) with standard test methods (ASTM numbers) and upload their PDF on the GMIU Web Portal.	10
4	Cetane & Octane Number Comparison: Students will create a comparison table of cetane vs octane number, including factors affecting them, additives used for improvement, and upload the PDF on the GMIU Web Portal.	10
5	Viscosity & Viscosity Index: Students will collect viscosity data at two different temperatures for two lube oil samples and calculate viscosity index. The final worksheet will be uploaded as PDF on the GMIU Web Portal.	10
Total		50



Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	25%	50%	25%	00%	00%	00%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:

CO1	Define various test properties of crude oil and petroleum products and also explain their physical significance.
CO2	Explain crude oil processing, treatment techniques and cracking reactions taking place in a petroleum refinery.
CO3	Apply acquired knowledge of refinery processing and manufacturing technologies of producing petrochemicals for problem solving.
CO4	Compare various routes of production of widely used petrochemicals.
CO5	Understand Various Carbon contained product Refining in petrochemical industry.

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction. Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses. The internal evaluation will be done on the basis of Active Learning Assignment.



Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

- [1] B. K. Bhaskar Rao, Modern Petroleum Refining Processes, Oxford and IBH 2007.
- [2] M Gopal Rao, Dryden's Outlines of chemical technology, 3rd Edition East-West press pvt. Ltd, Delhi
- [3] B.K. Bhaskar Rao, A Text on Petrochemicals, 2nd Edition, Khanna Publishers, Delhi, 1998
- [4] George Austin, Shreve's Chemical Process Industries, 5th edition McGraw Hill publication – New Delhi.
- [5] W.L. Nelson, Petroleum Refinery Engineering, McGraw Hill, New York, 1958.

