

GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL SCIENCE AND TECHNOLOGY (35)

Chemical Process Technology

SUBJECT CODE: 2143505

B.E. 4th SEMESTER

Type of course: Environmental Science & Technology

Prerequisite: A good fundamental backup of manufacturing processes of different chemical compounds.

Rationale: The main objective of this subject is to make students aware about the manufacturing procedures of different chemical compounds and their engineering aspects because it is necessary to identify the potential hazardous chemicals which are to be generated through these processes.

Teaching and Examination Scheme:

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

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Crude distillation: Petroleum crude characteristics, Natural Gas, Crude distillation, Manufacturing Processes of ethylene, propylene, butanes, benzene, toluene & xylene. Butadiene, & the rest C4 components. Manufacture of synthesis gas from Natural gas, Naphtha and coal.	10	20
2	Petrochemicals: Process engineering aspects of manufacture of Methanol & methanol based chemicals such as acetic acid, dimethyl ether, dimethyl carbonate, etc. Ethylene oxide, glycols, vinyl chloride, vinyl acetate, Propylene oxide, hydroformylation of propene to manufacture butyraldehyde. Manufacture of aromatics, terephthalic acid, phthalic anhydride, phenol, nitrobenzene, aniline.	12	30
3	Inorganic and fertilizer industry. Manufacturing Processes of Sulphuric acid, Ammonia & Nitric acid, Urea, Chlor alkali (Caustic Soda & Soda ash) Phosphoric acid.	12	20
4	Fermentation industry: Industrial alcohol, absolute alcohol, beers wines and liquors,	6	15

	Manufacturing of Citric acid by Fermentation		
5	Water conditioning and air separation: Water conditioning methods: Ion exchange, lime soda process, deaeration, demineralization and desalting. Air separation.	6	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
27	28	28	10	7

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

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.

Reference Books:

1. Chemical process Industries Shreve, Brink & Austin, Mc Graw Hill ,4th Ed., 1984
2. Dryden's outlines of chemical technology for the 21st century, third edition by M Gopal Rao & Marsal Sitting, East-West Press Publications.
3. Chemical Process Technology, J Moulijn, M Makkee and A Diepen, John Wiley & Sons, 2001
4. Encyclopedia of Environmental Science & Technology ,Kirk & Othmer, John Wily & Sons, 5th Ed., 2007
5. Encyclopedia of Industrial Chemistry ,Ullmann, VCH, 1996
6. Industrial Organic Chemistry ,Weissermel K & Arpe H.J., Weinheim, 1978

Course Outcome:

After learning the course the students should be able to:

1. Understand different manufacturing processes of different chemical compounds
2. Engineering aspects
3. Significance of them
4. Uses

List of Experiments:

Minimum 5 practicals to be performed and remaining time should be allotted to open-ended projects/study reports/latest outcomes in technology study:-

1. In the beginning of the academic term, faculties will have to allot their students atleast one Open-ended Project / Study Report /Latest outcome in technology.
2. Literature survey including patents and research papers of fundamental process
 - Design based small project **or**
 - Study report based on latest scientific development **or**
 - Technology study report/modeling/ simulation/collection report **or**
 - Computer based simulation / web based application/ analysis presentations of basic concept field which may help them in chemical engineering.
3. These can be done in a group containing maximum **three students** in each.
4. Faculties should cultivate problem based project to enhance the basic mental and technical level of students.
5. Evaluation should be done on **approach of the student on his/her efforts** (not on 4. Faculties should cultivate problem based project to enhance the basic mental and technical level of students.
6. Evaluation should be done on approach of the student on his/her efforts (not on completion) to study the design module of given task.
7. In the semester student should perform **minimum 5** set of experiments and complete one **small open ended dedicated project** based on engineering applications.This project along with any performed experiment should be **EVALUATED BY EXTERNAL EXAMINER.**

PRACTICALS (ANYFIVE):

1	Preparation of Caustic soda
2	Acid value
3	Hardness of Water
4	TDS
5	Dissolved Oxygen
6	Redwood Viscometer
7	Aniline point
8	Smoke point

Design based Problems (DP)/Open Ended Problem:

Students are free to select any area of chemical process technology based on to define Projects.

Major Equipment:

Muffle furnace, Hot air oven, Viscometer, Smoke Point apparatus, aniline point apparatus, Heating mentle, pH meter.

List of Open Source Software/learning website:

- nptel.ac.in

ACTIVE LEARNING ASSIGNMENTS:

Preparation of power-point slides, which include videos, animations, Pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus is covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three Works should be sent to achievements@gtu.edu.in.