

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING CHEMICAL PROCESS INDUSTRIES - I

SUBJECT CODE: 2130505

B.E. Semester: III

Type of course: Chemical Engineering.

Prerequisite: Basic Concept of Chemistry.

Rationale: The main objective of this subject is to study the basics of chemical processes take place in chemical industries. This subject provides knowledge regarding to the basic aspects of manufacturing of various chemicals.

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)	
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Topic	Teaching Hours	Module Weightage (%)
1.	Chemical processing and the work of chemical engineering: Basic chemical data, batch and continuous processing, flowcharts etc.	02	30
2.	Water : Water treatment for industrial and domestic use such as demineralization, deionization, desalination, reverse osmosis, etc...	06	
3.	Sulfur and Sulfuric acid: Mining of sulfur, Manufacture of sulfuric acid by DCDA process and its applications. Manufacturing technologies, Engineering problems, Energy recovery from the process. Introduction to Fertilizer industries, manufacturing processes of Ammonia, Urea, Nitric acid, Phosphoric acid their uses and applications, major engineering problems, NPK fertilizer.	08	
4.	Chlor-alkali and Heavy Inorganic industry: Manufacturing of caustic soda and chlorine by membrane cell process, Manufacturing of Sodium bicarbonate.	06	20
5.	Introduction to industrial gases and carbon: Gases like carbon dioxide, oxygen, nitrogen, hydrogen, rare gases of atmosphere, helium, acetylene, sulfur dioxide, carbon monoxide, nitrogen oxide. Carbon like carbon black, activated carbon, natural graphite, Manufacturing of graphite and carbon, industrial diamonds.	08	50
6.	Introduction to ceramic industries. Portland cements, calcium and magnesium compounds, glass industries.	08	
7.	Introduction to explosives, propellants and toxic chemical agents, photographic products industries.	08	
8.	Introduction to pulp and paper industries: Kraft process, Paper making process ,etc..	08	

Reference Books:

1. "Shreve's Chemical Process Industries", George T. Austin, McGraw Hill Publication, 5th edition
2. "DRYDENS outlines of chemical technology for the 21st century", M Gopalarao & Marshal Sitting, pub East-West Press, 3rd edition
3. "General chemical technology", Shukla and Pandey.

Course Outcome:

After learning the course the students should be able:

1. To build a basic knowledge of the process carried out in chemical industry.
2. To review the practical importance and relevance of process takes place in chemical industry.
3. To be able to utilize the technological methods in problem solving in process plant.
4. To study about the salient features of the process.
5. To build a bridge between theoretical and practical concept used in industry.

List of Experiments and Open Ended Projects:

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 at least 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 completion) to study the design module of given task.
6. 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 (ANY FIVE):

1.	To prepare hydrated lime from the given calcium carbonate powder
2.	To prepare caustic soda by chemical method.
3	To prepare soap in the laboratory and carry out its cost analysis.
4.	To determine saponification value of oil sample.
5.	To prepare detergent in the laboratory and to carry out its cost analysis.
6.	To determine the acid value of the given sample of oil.
7.	To prepare m-dinitrobenzene from Nitrobenzene.
8.	To prepare ammonia from the ammonium salt with a strong base.
9.	To study the operations of water softener.
10.	To study deionization unit.

Open Ended Project fields:-

Students are free to select any area of science and technology based on chemical engineering applications to define Projects.

Some suggested projects are listed below:

- Laboratory set up of ionization unit.
- Carry out analysis (cost & composition) of soap, detergent, different oils, etc...
- Product profile and its manufacturing process like cement, glass, ceramic etc.

Major Equipments:

Muffle Furnace, Laboratory Oven etc...

List of Open Source Software/learning website:

- 1) Literature available in any laboratory manual of Chemical Process Industries.
- 2) Handbook on Soaps- Detergents & Acid Slurry 2nd Edition by Niir Board
- 3) NPTEL
- 4) MIT Open course lecture available on Internet etc...

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 to be 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 submit to GTU.