GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Chemical Engineering

Course / Subject Code: DI03005041

Course / Subject Name: Chemical Process Technology – I

w.e.f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	Foundational knowledge of chemical engineering calculations, unit operations, and unit processes is required.
Rationale:	The importance of this subject arises from the need of providing comprehensive and balanced understanding of essential link between chemistry and the chemical industry. It is vital to develop simple but meaningful flow diagram for each chemical product which a student can understand. This course develops skill for arranging and understanding treatment, reaction and separation steps in a flow diagram for variety of chemicals including acids, chloro-alkalis, cement, lime, coal, coal chemicals, polymer, cyclic intermediates & dyes, pharmaceutical products, Soap, detergents, glycerin and many other products. Diploma holders utilize this skill to read and recognize each step of process flow diagrams during their job. The area of job may be production, R and D, design, technical services, project development, sales and marketing etc.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes	RBT Level
01	Explain the classification and properties of various chemicals.	R/U
02	Apply concept of the manufacturing processes of various chemicals with neat sketch to operate chemical plant.	A
03	Identify major engineering problems encountered in manufacturing processes.	R/U
04	Suggest applications of various chemicals.	R/U/A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/ Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No.of Hours	%of Weightage
Unit-I Acid And Alkali	1.1 Scope and classification of chemical Industries 1.2 Physical properties and uses of Sulphuric acid, HCL, soda ash and caustic soda 1.3 Manufacture of: 1.3.1 Sulphuric acid by DCDA process 1.3.2 Hydrochloric acid 1.3.3 Soda ash by Solvay process 1.3.4 Caustic soda by electrolytic process 1.4 Major engineering problems of sulphuric acid and soda ash manufacturing	12	26% (18Marks)
Unit-II Cement And Lime	2.1 Define cement and lime 2.2 Properties and uses of cement and lime 2.3 Types of cement 2.4 Manufacture of Portland Cement and lime 2.5 Major Engineering problems of cement industry	06	14% (10Marks)
Unit-III Coal And Coal Chemicals	3.1 Properties of coal 3.2 Types of coal and coal chemicals 3.3 Coking of coal 3.4 Distillation of coal tar 3.5 Gasification of coal 3.6 Hydrogenation of coal	06	14% (10 Marks)
Unit-IV Polymers	4.1 Classify polymers 4.2 Properties and uses of Polymer 4.3 Manufacture of 4.3.1 Polyethylene by Philips process 4.3.2 Phenol formaldehyde 4.3.3 Urea formaldehyde 4.3.4 Nylon 6,6 4.3.5 Styrene Butadiene rubber 4.3.6 Polyester Fiber	08	18% (12Marks)

Unit-V Cyclic Intermediate and dyes	5.1 Definition and applications of dye 5.2 Classification of dyes 5.3 Manufacture of 5.3.1 Nitrobenzene 5.3.2 Aniline by reduction of nitrobenzene, 5.3.3 Anthraquinone from phthalic anhydride, 5.3.4 Vat dye 5.3.5 Indigo dye	07	15% (10Marks)
Unit-VI Soap, Detergent and Glycerin	6.1 Define and application: Soap, Detergent and Glycerin 6.2 Manufacture of 6.2.1 Soap by continuous hydrolysis and saponification 6.2.2 Linear Alkyl Benzene (LAB) 6.2.3 Detergent powder 6.2.4 Glycerin	06	13% (10 Marks)
	Total	**45**	**100% (70 Marks)**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
24	**52**	**24**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.

Suggested Course Practical List:

Sr. No.	**Practical Outcomes (PrOs)**	**UnitNo.**
1	Standardize sulfuric acid solution	1
2	Standardize hydrochloric acid solution	1
3	Standardize sodium hydroxide solution	1
4	Prepare hydrated lime	2
5	Find out moisture content in coal sample	3

6	Determine calorific value of coal sample	3
7	Prepare phenol formaldehyde	4
8	Prepare Urea formaldehyde	4
9	Use simple tests to identify some polymers	4
10	Prepare nitrobenzene	5
11	Prepare aniline	5
12	Prepare indigo dye	5
13	Prepare soap	7
14	Prepare detergent	7
15	Prepare glycerin	

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a suggestive list. Course teacher can select any 14 practical.*

i. *The **following are some sample** 'Process' and 'Product' related skills(more may be added/deleted depending on the course) with approximate percentage weightage that occur in the above listed **Practical Exercises** of this **course** required which are embedded in the Cos and ultimately the competency.*

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in% (Approximate)
1	Prepare experimental setup accurately.	10
2	Use apparatus for precise measurements.	20
3	Practice and adapt good and safe measuring techniques.	10
4	Good Record keeping of the observations accurately.	20
5	Interpret the results and their conclusion.	20
6	Prepare Report in prescribed format	10
7	Viva-Voce	10
Total		**100**

Suggested Activities for Students:

Other than the classroom and laboratory learning, the following are the suggested student- related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various out comes in this course: Students should perform the following activities in group and prepare small reports of about 5 pages for each activity. They should also collect/record physical evidence such as photographs/videos of the activities for their (student's) portfolio which will be useful for their

placement interviews:

a) Prepare a Power Point presentation or animation showing different types of chemical manufacturing Process
b) Prepare a model of different chemical product flow diagram
c) Preparation of tables showing the difference between Organic and Inorganic Compounds.
d) Market survey of different Chemical product and compare their physical and chemical properties.
e) Library survey regarding polymers and fertilizers in different industries.
f) Collect different polymers and prepare the chart/Power Point based on their type, properties, and uses.

References / Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with the place, year and ISBN
1	Outlines of Chemical Technology, 3rd edition	M. Gopala Rao, Marshall Sitting	Affiliated East West Press (Pvt) Ltd-New Delhi
2	Shreve's Chemical Process Industries, 5th edition	Austin G.T.	McGraw Hill publication –New Delhi
3	Chemical Technology - Vol. I and II, 2nd edition	G.N. Pandey and Shukla	Vani Books Company -Hyderabad
4	A Text Book on Petrochemicals, 2nd edition	Rao B. K. B.	Khanna Publishers – New Delhi

(b) Open source software and website:

(1) http://www.epa.gov/sectors/sectorinfo/sectorprofiles/chemical.html
(2) www.emis.vito.be/sites/default/Bref_cement_and_lime_production.pdf
(3) www.docbrown.info/page04/Mextract.htm
(4) http://www.goiit.com/posts/show/0/content-general-principles-of-extraction- of-metals-804401.htm
(5) http://www.contentshoppe.com/images/eLearning/sample2.swf
(6) http://www.petrochemistry.net/coal-chemicals.html
(7) http://www.auroma.in/propertiescoal.pdf

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