

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

CHEMICAL PROCESS TECHNOLOGY-I (Code: 3330505)

Diploma Programme in which this course is offered	Semester in which offered
Chemical Engineering	3 rd Semester

1. 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-alkalies, cement, lime, coal, coal chemicals, plastics, dyes and intermediates, pharmaceutical products, soap and detergents 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. Thus it is a key course every chemical engineer should develop mastery over it.

2. COMPETENCIES (Programme Outcome according to NBA Terminology):

The course content should be taught and implemented with the aim to develop different types of skills so that student is able to acquire following competencies.

- Prepare flow charts for manufacturing important chemicals in plants.
- Prepare important chemicals in laboratory

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	06	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Acid And Alkali	1a. Classify chemical Industries	1.1 Scope and classification of chemical Industries
	1b. Describe properties and uses	1.2 Properties and uses of Sulphuric acid, HCL, soda ash and caustic soda
	1c. Prepare flow diagram and Explain manufacture	1.3 Manufacture of:(i) sulphuric acid by DCDA process (ii) Hydrochloric acid (iii)soda ash by Solvay process (iv)caustic soda byelectrolytic process
	1d. Explain major engineering problems	1.4 Major engineering problems of sulphuric acid and soda ash manufacturing
Unit– II Cement And Lime	2a. Describe cement and lime	2.1 Introduction of cement and lime 2.2 Properties and uses of cement and lime 2.3 Types of cement
	2b. Prepare flow diagram and explain manufacture	2.4 Manufacture of Portland Cement and lime
	2c. Explain major engineering problems	2.5 Major Engineering problems of cement industry
Unit– III Metallurgical Industries	3a. Describe various ores	3.1 Iron ores, bauxite and copper pyrites
	3b. Explain manufacture with neat figure	3.2 Production of pig iron by Bessemer process, Aluminum from bauxite; and extraction of copper from copper pyrites
Unit– IV Coal And Coal Chemicals	4a. Describe coal & coal chemicals	4.1. Types of coal and coal chemicals
	4b.	4.2. Coking of coal
	4c. Explain coal processes	4.3. Distillation of coal tar 4.4. Gasification of coal 4.5. Hydrogenation of coal
Unit– V Polymers	5a. Classify polymers	5.1 Classification of polymers
	5b. Differentiate thermosetting and thermoplastic polymer	5.2 Thermosetting and thermoplastic polymers
	5c. Prepare flow diagram and explain manufacture	5.3 Manufacture of (i) Polyethylene by Philips process (ii)Polyvinyl chloride (iii)Phenol formaldehyde (iv)Nylon 6,6 (v) Polyester Fibre
Unit– VI Dyes And Intermediates	6a Explain dye	6.1. Definition & applications of dye
		6.2. Classification of dyes
	6b Construct flow diagram	6.3. Manufacture of

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	and explain manufacture	(i) Aniline by reduction of nitrobenzene, (ii) Anthraquinone 6.4. from phthalic anhydride, 6.5. Vat dye and 6.6. Reactive dye
Unit– VII Miscellaneous	7a. Describe soap and Detergent	7.1 Soap and detergent
	7b. Prepare flow diagram and Explain manufacture	7.2 Manufacture of (i) soap by 7.3 continuous hydrolysis and 7.4 saponification (ii) Linear Alkyl 7.5 Benzene(LAB)
	7c. Describe explosives and propellants	7.6 Explosives - Ammonium 7.7 nitrate, TNT and RDX a. Important Propellants

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Acids-Alkali	14	04	09	04	17
II	Cement and Lime	07	02	05	02	09
III	Metallurgical Industries	07	03	04	02	09
IV	Coal and Coal chemicals	05	02	04	01	06
V	Polymers	08	02	05	03	10
VI	Dyes and Intermediates	08	02	05	03	10
VII	Miscellaneous	07	03	04	02	09
	Total	56	18	36	17	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised 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.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Apprx. Hrs. Required
1	I	Standardize sulfuric acid solution	02
2	I	Standardize hydrochloric acid solution	02
3	I	Standardize sodium hydroxide solution	02
4	II	Prepare hydrated lime	02
5	III	Beneficiate ores	02
6	IV	Determine calorific value of coal	02
7	V	Prepare phenol formaldehyde	02
8	VI	Identify some polymers using simple tests	02
9	VI	Prepare nitrobenzene	02
10	VI	Prepare indigo dye	02
11	VI	Prepare vat dye	02
12	VI	Prepare reactive dye	02
13	VII	Prepare soap	02
14	VII	Prepare detergent	02
Total			28

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: course/topic based presentations, internet based assignments, teacher guided self learning activities, and MCQ/Quiz. These could be individual or group-based.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. More examples of Flow Charts should be discussed in the class to make concepts clear. Home Assignment should be given to students on preparing flow charts for more practice.
- ii. Video/animation films may be shown for explaining abstract concepts and manufacturing process in industries.
- iii. Samples of detailed flow charts from Industries may be collected and students may be asked to interpret them.

9. SUGGESTED LEARNING RESOURCES

A. List of Books:

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

B. List of Major Equipment/Materials

(i) Glassware: Conical flask, burette, pipette, round bottom flask, measuring cylinder, beaker (ii) Glass Assembly: Round bottom flask, reaction vessel, condenser, separating vessel (iii) Burner (iv) Weight balance (minimum 0.1 gm) (v) Heating and cooling bath

C List of Software/Learning Websites

- i. <http://www.epa.gov/sectors/sectorinfo/sectorprofiles/chemical.html>
- ii. www.emis.vito.be/sites/default/Bref_cement_and_lime_production.pdf
- iii. www.docbrown.info/page04/Mextract.htm
- iv. <http://www.goiit.com/posts/show/0/content-general-principles-of-extraction-of-metals-804401.htm>
- v. <http://www.contentshoppe.com/images/eLearning/sample2.swf>
- vi. <http://www.petrochemistry.net/coal-chemicals.html>
- vii. <http://www.auroma.in/propertiescoal.pdf>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. R P Hadiya**, Lecturer in Chemical Engineering, Govt. Polytechnic, Rajkot
- **Prof. S K Charola**, Lecturer in Chemical Engineering, Sir BPTI, Bhavnagar
- **Prof. N N Hansalia**, Lecturer in Chemical Engineering, Govt. Polytechnic, Rajkot

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof Bashir Shaikh**, Assistant Professor, Department of Applied Sciences.
- **Prof Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat