

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**  
**COURSE TITLE: CHEMICAL PROCESS TECHNOLOGY-II**  
**(Code: 3340503)**

Diploma programme in which this course is offered	Semester in which offered
Chemical Engineering	4 <sup>th</sup> Semester

### 1. RATIONALE

This course provides the essential link between chemistry and the chemical industry. It is vital to develop the comprehensive understanding about the fundamental knowledge and manufacturing process for various chemical products. This course develops the skill to understand and arrange the treatment, reaction and separation steps in a flow diagram of chemical production process. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

### 2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop required skills so that students are able to acquire following competency:

- **Prepare flow diagram for the manufacturing of various chemical products.**

### 3. COURSE OUTCOME

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Explain Manufacture of Vegetable oil, Sugar from sugar-cane, Starch from maize and Dextrin from starch
- Describe manufacturing of pulp and paper industries with major engineering problems
- Prepare flow diagram and Explain manufacturing of fuel gases
- Prepare flow diagram and Explain manufacturing of Ethyl alcohol by fermentation, lactic acid from corn sugar, citric acid from molasses and vinegar by Frings' method
- Explain manufacturing of rubber chemicals
- Explain manufacturing of various pharmaceutical products.
- Describe manufacturing process of pesticides
- Explain Production of bromine from sea water

### 4 TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme								
L	T	P		Theory Marks		Practical Marks		Total Marks				
L	T	P	C	ESE	PA	ESE	PA	200				
4	0	4 0	08	06	70	70	30		30	40	20	60

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

**5. COURSE DETAILS**

<b>Unit</b>	<b>Major Learning Outcomes (in cognitive domain)</b>	<b>Topics and Sub-topics</b>
<b>Unit – I</b> <b>Natural Product Industries</b>	1a. Define oil and fat	1.1 Basics of oil and fat
	1b. Describe physical properties of oil	1.2 Physical properties of oil
	1c. Describe carbohydrates	1.3 Introduction to Carbohydrates
	1d. Draw flow diagram explain manufacturing process of (i) Vegetable oil (ii) Hydrogenated products of oil (iii) Sugar from sugar-cane (iv) Starch from maize (v) Dextrin from starch	1.4 Manufacturing Process of (i) Vegetable oil (ii) Hydrogenated products of oil (iii) Sugar from sugar-cane (iv) Starch from maize (v) Dextrin from starch
	1e. Distinguish chemicals available from the sea	1.5 Chemicals from sea
	1f. Draw flow diagram describe manufacturing process of bromine from sea water.	1.6 Production of bromine from sea water
<b>Unit – II</b> <b>Pulp and Paper Products</b>	2a. Explain pulp and paper	2.1. Fundamentals of Pulp and paper
	2b. Distinguish methods of pulp production 2c. Describe various steps of pulp production 2d. Draw flow diagram explain manufacturing of paper using Fourdrinier machine	2.2. Methods of pulp production 2.3. Sulphate (Kraft) pulp process 2.4. Manufacturing of paper using Fourdrinier machine
	2e. Identify major engineering problems of paper manufacturing	2.5. Paper manufacturing
	<b>Unit – III</b> <b>Fuel and Industrial Gases</b>	3a. Classify fuels 3a1. List types, sources, uses of fuels
3b. List types, sources, uses of industrial gases		3.2 Important industrial gases: types, sources, uses
3c. Draw flow diagram explain manufacturing process of fuel gases		3.3 Production of fuel gases (i) producer gas (ii) water gas (iii) coke oven gas (iv) natural gas
3d. Describe industrial electrolytic process		3.4 Industrial electrolytic processes
3e. Describe Cryogenic for producing industrial gases		3.5 Cryogenic
<b>Unit – IV</b> <b>Fermentation Industries</b>	4a. Classify fermentation 4a1. List types of fermentation	4.1. Fermentation
	4b. Draw flow diagram explain manufacturing (i) Ethyl alcohol by fermentation (ii) Lactic acid from corn sugar	4.2. Manufacture of (i) Ethyl alcohol by fermentation (ii) Lactic acid from corn sugar (iii) Citric acid from molasses

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	(iii) Citric acid from molasses (iv) vinegar by Frings' method	(iv) vinegar by Frings' method
	4c. Describe use of biotechnology in chemical engineering	4.3. Biotechnology in Chemical Engineering
<b>Unit – V</b> <b>Rubber</b> <b>Chemicals</b>	5a. Define rubber 5b. Describe production of natural rubber 5b1. List properties and uses of natural rubber 5c. Classify synthetic rubbers 5c1. List uses of synthetic rubber	5.1 Fundamentals of rubber 5.2 Natural rubber 5.3 Synthetic rubbers
	5d. Explain compounding procedure for rubber	5.4 Compounding of rubber
	5e. Draw flow diagram for manufacturing of (i) styrene butadiene rubber (ii) poly butadiene rubber (iii) chloroprene (iv) nitrile rubber	5.5 Manufacturing of (i) styrene butadiene rubber (ii) poly butadiene rubber (iii) chloroprene (iv) nitrile rubber
<b>Unit – VI</b> <b>Pharmaceut</b> <b>icals</b>	6a. Classify pharmaceutical products on the basis of use (with examples)	6.1. Pharmaceutical products
	6b. Distinguish Important drugs	6.1. Important Drugs (i) Antipyretic (ii) Anaesthetic (iii) Analgesic (iv) Anti-malarial (v) Anti-TB drugs (vi) Antibiotics (vii) Antihistamine (viii) Vitamins
	6c. Draw flow diagram and explain manufacturing of (i) Antibiotics, (ii) Aspirin, (iii) Paracetamol	6.3(i) Antibiotics, (ii) Aspirin, (iii) Paracetamol
<b>Unit-VII</b> <b>Pesticides</b>	7a. Describe the important Pesticides	7.1 Important pesticides: (i) Algicide, (ii) Bactericide, (iii) Fungicide, (iv) Herbicide, (v) Insecticide (vi) Biopesticide
	7b. Formulate pesticides	7.2 Formulation of Pesticide
	7c. Draw block diagram and explain manufacturing of (i) methyl bromide (ii) 2-4 Dichlorophenoxy acetic acid	7.3 Manufacturing process of (i) methyl bromide (ii) 2-4 Dichlorophenoxy acetic acid

## 6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Natural Product Industries	11	04	06	04	14
2.	Pulp and Paper Products	06	02	04	01	07
3.	Fuel and Industrial Gases	08	03	05	02	10
4.	Fermentation Industries	08	02	06	02	10
5.	Rubber Chemicals	08	02	06	02	10
6.	Pharmaceuticals	09	04	06	02	12
7.	Pesticides	06	02	03	02	07
	<b>Total</b>	<b>56</b>	<b>19</b>	<b>36</b>	<b>15</b>	<b>70</b>

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

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

## 7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**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 outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

*Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.*

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1	I	Estimate Acid value in oil sample	04
2	I	Estimate iodine value in oil sample	04
3	I	Prepare starch from maize	04
4	I	Extract vegetable oil from seed	04
5	I	Prepare Glycerine	04
6	I	Estimate NaCl content in sea water	04
7	II	Prepare pulp from bamboo	04
8	III	Estimate moisture, volatile matter and ash content in fuel	04
9	IV	Prepare alcohol	04
10	IV	Prepare citric acid	04

11	IV	Prepare vinegar	04
12	V	Analyse rubber products	04
13	VI	Prepare Aspirin	04
14	VI	Prepare Paracetamole	04
<b>Total Hours</b>			<b>56</b>

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Prepare course/topic based presentations for seminars
- ii. Visit websites of reputed process plant industries

## 9. SPECIAL INSTRUCTIONAL STRATEGY ( If Any)

- i. Arrange visit to nearby industries
- ii. Show vides/animation films/photographs of different process plants.
- iii. Give internet based assignments
- iv. Give mini projects on preparing feasibility report for preparing different chemicals on commercial scale.

## 10. SUGGESTED LEARNING RESOURCES

### A. List of Books

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

### B. List of Major Equipment/ Instrument with Broad Specifications

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

### C. List of Software/Learning Websites

- i. [www.epa.gov/sectors/sectorinfo/sectorprofiles/chemical.html](http://www.epa.gov/sectors/sectorinfo/sectorprofiles/chemical.html)
- ii. [www.naturalproductsexpoindia.com/](http://www.naturalproductsexpoindia.com/)
- iii. [www.andritz.com/pulp-and-paper/pp-pulp-production.htm](http://www.andritz.com/pulp-and-paper/pp-pulp-production.htm)
- iv. [www.linde-gas.com/en/products\\_and\\_supply/gases\\_fuel/index.htm](http://www.linde-gas.com/en/products_and_supply/gases_fuel/index.htm)

- v. <http://chemistry.about.com/od/biochemistry/a/carbohydrates.htm>
- vi. [www.azom.com/article.aspx?ArticleID=3580](http://www.azom.com/article.aspx?ArticleID=3580)
- vii. [www.iisrp.com/WebPolymers/00Rubber\\_Intro.pdf](http://www.iisrp.com/WebPolymers/00Rubber_Intro.pdf)
- viii. <http://www.niehs.nih.gov/health/topics/agents/pesticides/>
- ix. <http://levine.sscnet.ucla.edu/papers/imbookfinal09.pdf>

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

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

### Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur**, Associate Professor, Department of Applied Sciences,
- **Dr. Bashirullah Shaikh**, Assistant Professor, Department of Applied Sciences,