Bachelor of Technology (B.Tech)

B. Tech. Semester III

Subject Code:BTCH13303

Subject Name: Chemical Process Technology I

Type of course: Professional Core Courses
Prerequisite: Basic Chemistry
Rationale: The course offers fundamental principles of chemical engineering Unit processes and Manufacturing technology. This course offers important contribution to understand chemical reactions present in different production routes for various chemicals. Many complex chemical reactions and complex transport processes occur for Industrial manufacture.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
2	0	2	3	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Introduction** Definition and importance of unit processes in chemical engineering, Concept of unit operation and unit processes and their role in systematizing the cognitive structure of chemical industries, Classification of unit processes, Chemical process kinetics and Factors affecting, Symbols used in Chem. Engineering, Process flow diagram, Introduction to thermo-chemistry	3	10 %
2.	**Halogenation** Definition and scope of halogenation reactions, Thermodynamics and kinetics of halogenation reactions Halogenating agents, Industrial halogenation with types of equipment, Manufacturing of Chlorobenzene, Benzene hexa chloride and vinyl chloride from Ethylene and Acetylene.	3	10%
3.	**Chlor-Alkali Industry** Manufacture of soda ash by solvay and modified solvay	3	10%

	process, Electrolytic process for caustic soda, different types of cell, manufacturing of chlorine and hydrogen, hydrochloric acid, common salt by vacuum evaporation process		
4.	**Esterification and Hydrolysis** Definition and scope of Esterification, Esterification by organic acids and by carboxylic acid derivatives, Esters by addition to unsaturated systems and inorganic acids, Definition and scope of hydrolysis, Hydrolyzing agents, Mechanism Kinetics, thermodynamics, of hydrolysis. Manufacture of phenol from benzene sulfonic.	4	13%
5.	**Hydrogenation** Definition and scope of hydrogenation, Hydrogen production and properties, Gas catalytic hydrogenation and hydrogenlysis, Kinetics and thermodynamics of hydrogenation reactions, General principles concerning hydrogenation catalysts, Industrial hydrogenation of fat & oil, Production of methanol from CO_2 & H_2. Hydrogen production technologies	2	7%
6.	**Oils, Fats, Soaps & Detergents** Vegetable oil Extraction method using Mechanical and Solvent extraction process , hydrogenation of oil, cleaning mechanism of soaps and detergents, manufacturing of soaps and glycerine, manufacturing of detergents	3	10%
7	**Sugar, Paints, Pigments** Manufacturing of Sugar, Manufacturing of ethanolby fermentation route. Hydrolysis of fat, hydrolysis of carbohydrates, starch to dextrosePaints, different types of pigments such as white, blue, red, yellow, green, brown, etc , Varnishes, Industrial Coatings, printing inks, Polishes etc	3	10%
8	**Cement & Glass Manufacturing** Lime stone beneficiation and Manufacturing of cement , types of cement, manufacturing of glass, types of glass	3	10%
9	**Amination by ammonolysis** Definition & types of reactions, Aminating agents, Physical and Chemical factors affecting it. Catalyst used in ammonolysis, Kinetics and Thermodynamics of ammonolysis. Manufacture. of Aniline from chlorobenzene and Nitroaniline from Dichloro Nitro Aniline	2	7%
10	**Sulfonation and sulfation technology** Definition and scope of sulfonation and sulfation, Chemical and physical factors in sulfonation and sulfation, The desulfonation reaction, Use of SO_3, SO_2, H_2SO_4 as sulfonating and sulfating agents and their applications, Manufacture of Benzene sulfonates, Sulfation of Dimethyl Ether and Lauryl Alcohol.	2	7%

11	**Dyes and Intermediates:** Classification of dyes according to constitution and application, various dyes such as Azo dyes, Anthroquione dyes, Triamyl dyes, dispersed dyes, Misc. Dyes such as azine, oxazines, thiazines, thiazoles, nitro dyes etc. Various dye intermediates based on unit processes, Manufacturing Processes of Chrome blue black,H-acid,Koch acid,Vinyl sulphone, Vat dyes,Nitro benzene,Aniline,etc.	2	7%

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
35	**35**	**15**	**15**	**00**	**00**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create 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 Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Shreve's Chemical Process Industries	Austin G. T.	McGraw Hill International		Edition 5th
2	Outlines of Chemical Technology	Dryden's (M. GopalaRao& Marshall Sitting,)	East West Press. Pvt. Ltd, New Delhi	1997	3rd
3	Encyclopedia of Industrial Chemistry	Ullmann'sEncyclopedia	VCH	1996	--
4.	Encyclopedia of Chemical Technology	Kirk and Othmer	--	--	3rd

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Develop fundamental understanding of the unit processes and unit operations carried out in chemical industries.	30
CO-2	Explain the basic reaction steps involved in the production of various grades	20

	of products.	
CO-3	Construct process flow diagrams for different chemical manufacturing plants.	20
CO-4	Understand and resolve technological and economicalproblems arising in chemical plants.	15
CO-5	Review the practical importance and relevance of processes taking place in chemical industry.	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	3	2	1	1	3	3	3	2	2	2	3	2	2	2
CO-2	3	3	2	1	1	3	3	3	2	2	2	3	2	2	1
CO-3	3	3	2	1	1	3	3	3	2	2	2	3	1	1	1
CO-4	3	3	2	1	1	3	3	3	2	2	2	2	2	2	3
CO-5	3	3	2	1	1	3	3	3	2	2	2	2	2	2	3
Rationale*	15	15	10	5	5	15	15	15	10	10	10	13	9	9	10

Rationale*: Explaining why it is matching this particular program outcome.

LIST OF PRACTICALS:

1. Crystallization of Sugar
2. To determine chiral chemical concentration using polarimeter
3. To prepare Aspirin from Salicylic acid
4. To PrepareSoap & Detergent
5. To Determine acid number of oil sample
6. To determine the percentage of nitrogen content of given NH_4Clsample by Formaline method.
7. To determine nitrogen content of given $(NH_4)_2SO_4$ sample byFormaline method

Major Equipment: Polari meter

List of Open Source/learning website:

https://nptel.ac.in/courses/103/106/103106108/

List of Open Source Software:

https://www.openmodelica.org/
https://dwsim.inforside.com.br/new/