B. Tech. Semester IV

Subject Name: Chemical Process Technology II **Subject Code: BTCH13403**

Type of course: Professional Core Courses

Prerequisite: Basic Chemistry and CPT -I

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.	**Oxidation Process :** Definition and Types of oxidative reactions, Oxidizing agents, Liquid phase oxidation with oxidizing compounds, Liquid-phase oxidation with oxygen, **Production :** Oxidation of toluene with MnO_2. Manufacturing of Acetaldehyde from Acetic acid and Manufacturing of Acetic acid from Ethanol; Vapor phase oxidation of Methanol, Benzene and Naphthalene, Apparatus and its M/s. for oxidation reactions.	3	10%
2.	**Sulphuric Acid Manufacturing** Manufacturing of elemental sulfur by Frasch process, Single and double Absorption process for manufacturing of sulfuric acid.	3	10%
3.	**Fertilizer Industry** **Nitrogenous Fertilizers:** Introduction to fertilizers, synthesis gas, Manufacturing of ammonia, Manufacturing of nitric acid, urea, ammonium nitrate & ammonium sulphate.	3	10%

4.	**Phosphatic Fertilizers:** Production of elemental phosphorus, manufacture of phosphoric acid by wet process and electric furnace process, single & triple super phosphate, Ammonium phosphate.	3	10%
5.	**Mixed Fertilizers:** compositions & constituents, granulation, controlled release fertilizers.	3	10%
6.	**Electrolytic Manufacturing of Aluminium & Magnesium** Purification of alumina from bauxite using Bayer process, Manufacturing of magnesium.	3	10%
7.	**Nitration** **Process:** Introduction to nitration reactions, Nitrating agents, Aromatic Nitration, Kinetics and mechanism of aromatic nitration, Nitration of paraffinic hydrocarbon, Thermodynamics of nitration, Process equipment for technical nitration - Schmid and Biazzi nitrator, Mixed acid for nitration, D.V.S. value and nitric reaction, Comparison of batch Vs. Cont. nitration. **Production :** Manufacture of Nitrobenzene, Dinitrobenzene, O-and P-Chloronitrobenzene, tri - nitrotoluene.	3	10%
8.	**Amination by reduction** **Process:** Introduction to Amination reactions, Various methods of reductions and factors affecting it, Iron and acid (Bechamp) reduction, Batch and continuous process for **Production :** Manufacture of Aniline from Nitrobenzene, Continuous process for manufacturing of Aniline from nitrobenzene using catalytic fluidized bed reactor.	3	10%
9.	**Polymerization** Introduction & chemistry of polymerization reactions, classifications of polymers methods of polymerization.	3	10%
10.	**Pulp & Paper Manufacturing** Kraft process and sulfite process for manufacturing of pulp, chemical recovery system, types of paper, paper manufacturing process.	3	10%

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	George F. Austin	McGraw Hill International		5th
2	Dryden's Outlines of Chemical Technology,	M. Gopala Rao & Marshall Sitting,	East West Press Pvt. Ltd., New Delhi		2nd
3	Encyclopedia of Industrial Chemistry	Ullmann's Encylopedia	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 of products.	20
CO-3	Construct process flow diagrams for different chemical manufacturing plants.	20
CO-4	Understand and resolve technological and economical problems 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	PSO 1	PSO 2	PSO 3
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. Preparation of Nitrobenzene, dinitrobenzene.
2. Oxidation using Photo catalytic reactor.
3. Preparation of Mordant Yellow.
4. Preparation of Fast Green-O. (Di-nitroso resorcinol).
5. Preparation of Disperse Dye.
6. Prepare indigo dye.
7. Manufacture of Polymer
8. Study Experiments.

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/