GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Chemical Engineering
Subject Code : BE03005021
Subject Name : Chemical Process Technology

w. e. f. Academic Year:	2024-25
Semester:	3
Category of the Course:	Professional Core Courses

Prerequisite:	None
Rationale:	The primary goal of this subject is to teach the fundamentals of chemical processes that occur in chemical and allied industries like pharmaceuticals, cement, etc. The subject imparts knowledge about the basic concepts for manufacturing various chemical compounds.

Course Outcome:
After completion of the course, students will be able to:

No	Course Outcomes
01	understand the manufacturing of various inorganic and organic chemicals
02	understand the process flow diagram and various process parameters
03	identify and solve engineering problems during production
04	understand the practical methods of production in a chemical plant.
05	build a bridge between theoretical and practical concepts applied in industry

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual**

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Chemical processing and the work of chemical engineering :** Basic chemical data, unit operation and unit process, batch and continuous processing, process flow sheet, environment aspects, safety aspects etc.	2	5
2.	**Sulphur, Sulphuric acid industry:** Mining and manufacturing of Sulphur, synthesis of Sulphur dioxide, Manufacture of Sulphuric acid and its applications, manufacturing technologies & associated engineering problems.	5	9
3.	**Fertilizer industry:** manufacturing processes of Ammonia, Urea, Nitric acid, Phosphoric acid, their uses and applications, manufacturing of phosphate fertilizers, major engineering problems, NPK fertilizer	5	10
4.	**Chlor-alkali and heavy inorganic industry:** Manufacturing of soda ash, Caustic Soda and Chlorine by membrane cell, mercury & diaphragm process.	4	9
5.	**Dye & its intermediates, paints and pigment industry:** Classification of dyes according to its constitution and application, Introduction to Disperse, Reactive, Azo dyes, H-acid, Koch acid, Vinyl sulphone, Vat dyes. Introduction to Paints classification & its constituents, PVC of Paints, different types of pigments such as white, blue, red, yellow, green, brown. Introduction to Varnishes, Solvent, Thinners & Industrial Coatings.	5	10
6.	**Soap and detergent industry:** Introduction to soap and detergent, soap manufacturing process, methods of detergent manufacture, manufacture of glycerine.	4	9
7.	**Drugs and pharmaceuticals industry:** Classification of various drugs and pharmaceuticals, Introduction of Antibiotics, Manufacturing of penicillin, Introduction of vitamins, Manufacturing processes of Aspirin, Vitamin-D, B-12, & C (Ascorbic acid)	4	10
8.	**Sugar & Fermentation Industry:** Manufacturing of Sugar. Fermentation process, Industrial Alcohol, Absolute Alcohol, Beers, Wines and Liquors, Manufacturing of Butyl Alcohol & Citric acid by fermentation.	4	10
9.	**Cement & ceramic industry:** Cement & Its types, Limestone benefication, manufacturing of Portland cement, lime manufacture. Introduction to Ceramic Industry, basic raw materials and ceramic chemistry, manufacturing of Refractory bricks.	4	10

10.	**Pulp and paper industry:** Pulp manufacturing by Kraft process, major engineering problems, chemical recovery, Manufacturing of Paper.	**4**	**9**
11.	**Industrial gases and carbon :** Importance of cryogenics in gas production**,** production of gases like carbon dioxide, oxygen, nitrogen, hydrogen, introduction to rare gases of atm. like helium and acetylene.	**4**	**9**
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**25**	**25**	**10**	**---**	**---**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per 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.

References/Suggested Learning Resources:

(a) Books:

1. "Shreve's Chemical Process Industry", George T. Austin, McGraw Hill Publication, 5th edition
2. "DRYDENS outlines of chemical technology for the 21st century", M Gopalarao & Marshal Sitting, pub East- West Press, 3rd edition.
3. "Ulmanns Encyclopedia of Industrial Chemistry", Wiley
4."Encyclopedia of Chemical Technology", Kirk and Othmer, Wiley Interscience.
5. "Unit processes in Organic synthesis", Groggins, P.H., Tata McGraw Hill Education Pvt Ltd.

(b) Open source software and website:

1. Students can refer to video lectures available on the websites including NPTEL.

LIST OF PRACTICALS: (Minimum 10 need to be performed)

Sr. No.	List of Experiments
1.	To prepare soap in the laboratory and carry out its cost analysis.
2.	To determine saponification value of oil sample
3.	To prepare detergent in the laboratory and to carry out its cost analysis.
4.	To determine the acid value of the given sample of oil.
5.	To prepare hydrated lime from the given calcium carbonate powder
6.	To prepare caustic soda by chemical method.

7.	To synthesis aspirin from salicylic acid.
8.	Preparation of phenyl azo – β – Naphthol from aniline.
9.	Preparation of disperse dye.
10.	To prepare mordant yellow dye.
11.	Preparation of fast green dye.
12.	Preparation of nitro benzene from benzene.
13.	To study Alcohol Fermentation by Saccharomyces cereviceae (Baker's Yeast).
14.	Fermentative production of citric acid using the fungi Aspergillus niger.

- **List of suggested activities for Problem Based Learning:**

Activity	No. of hours	Evaluation Criteria
Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on the report submitted. Report should contain observations and calculations based on industry/ lab data.
Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
Assignment writing	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
Industrial exposure for 2-3 days to observe and provide tentative solutions on society/ environment/ health/ any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions

Poster/chart/powerpoint preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.

- Above activities are suggestive, faculty can choose any of these activities and cover up the rest of the credit hour.
- The number of hour is suggestive. Faculty can sub-divide the number of hours based on the activity. However, the total number of hours is fixed.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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