GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Branch: Chemical Engineering (Green Technology and Sustainability Engineering)

Course/Subject Code: BE04044041

Course/Subject Name: Process Technology

W. E. F. Academic Year:	2024-25
Semester:	4
Category of the Course:	Professional Core

Prerequisite:	Applied Chemistry, Chemical Engineering Principles, Basic Thermodynamics
Rationale:	Process Technology is a core subject in Chemical, Petrochemical, and Allied Engineering programs. It forms the foundation for understanding how raw materials are transformed into valuable industrial products through chemical and physical processes. This subject introduces students to the principles, operations, and design aspects of major chemical and process industries such as petroleum refining, fertilizers, pharmaceuticals, textiles, and polymers. It also prepares them to adapt to emerging trends like green chemistry, process integration, and automation.

Course Outcome:

After Completion of the Course, Student will able to:

Sr. No.	CO statement
CO-1	Explain the basic structure and operation of major process industries.
CO-2	Interpret and construct process flow diagrams.
CO-3	Describe raw materials, reactions, and unit operations in chemical and allied industries.
CO-4	Analyze environmental, safety, and economic aspects of industrial processes.
CO-5	Propose cleaner and more sustainable process technologies.

Teaching and Examination Scheme:

Teaching /Learning Scheme in Hours Per Semester					Total Credits = TH/30	Examination Marks					Total Marks
						Theory Marks		Practical Marks			
L	T	P	PBL*	TH	03	ESE (E)	PA (M)	PA (I)	PBL	ESE (V)	
45	0	0	45	90		70	30	0	30	0	130

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

Course Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Process Industries:** Definition and scope of process technology. Overview of chemical process industries: organic, inorganic, petrochemical, polymer, food, and pharmaceutical sectors. Classification of industries based on feedstock and products. Flow sheet symbols and process diagram representation (block flow diagram, PFD, PID). Material and energy flow in process plants.	6
2	**Inorganic Chemical Process Industries:** Raw materials, manufacturing steps, reactions, and applications of: Sulfuric acid (contact process), Nitric acid (Ostwald process), Ammonia (Haber process), Soda ash and caustic soda, Cement and glass manufacturing processes. Pollution and waste management in inorganic industries.	8
3	**Organic and Petrochemical Industries:** Overview of petroleum refining: fractional distillation, cracking, reforming, and isomerization. Production of fuels and petrochemicals: Methanol, ethanol, formaldehyde, acetone, phenol, acetic acid, ethylene, propylene, benzene, toluene, and xylene. Production of polymer and plastic materials: polyethylene, PVC, nylon. Cleaner and energy-efficient technologies in petrochemical industries.	10
4	**Fermentation and Pharmaceutical Processes:** Basic principles of fermentation technology. Production processes for: Alcohol (ethanol fermentation), Citric acid, penicillin, and vitamins. Process technology in pharmaceutical synthesis (e.g., paracetamol, aspirin). Effluent treatment and by-product recovery.	7
5	**Agrochemical, Textile, and Polymer Processing:** Agrochemical production: urea, DAP, pesticides, and fertilizers. Textile wet processing: bleaching, dyeing, and finishing operations. Polymer processing and compounding: extrusion, molding, spinning. Cleaner technologies and sustainable process design.	8
6	**Process Integration, Safety, and Environmental Aspects:** Process optimization and energy integration (pinch technology). Waste minimization and recycling strategies. Safety management in process plants. Environmental regulations and green chemistry principles.	6

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**35**	**10**	**10**	**0**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Dryden, C.E., Outlines of Chemical Technology, East-West Press, 3rd Ed.
2. Shreve, R.N. and Brink, J.A., Chemical Process Industries, McGraw Hill.
3. Austin, G.T., Shreve's Chemical Process Industries, McGraw Hill.
4. M.G. Shetty, Industrial Chemistry, Chand & Co.
5. Bhatt, B.I. and Vora, S.M., Stoichiometry, Tata McGraw-Hill.
6. K.S. H. Rao, Chemical Process Technology, New Age International.

Open source software and website:

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

- **Activities suggested under self learning:**

Sl. No.	Name of the activity	No. of hours	Total Hours
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h	10
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h	10
3.	Assignment writing.	5 assignments of 2h each.	10
4.	Self learning on-line course	Minimum duration of the course should be 10h.	10
5.	Poster/chart/power point preparation on technical topics		6
6.	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h	10
7.	Group Discussion on emerging/trending technical topics based on subject		1 hr each
8.	Real world case studies based learning	Duration of data collection/study = 5h Report preparation = 5h	10

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