Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester 5 (Diploma)

Subject: Separation Technology DETCH15216

Type of course: Professional Elective Courses

Prerequisite: Basic Understanding about separation technique.

Rationale: A solid foundation in mass transfer, fluid flow, and basic thermodynamics is essential because separation processes rely heavily on these principles for effective design and operation. Familiarity with basic unit operations and process equipment ensures students can understand, analyze, and apply separation techniques in real-world chemical engineering applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	00	00	4	60	30	10	00	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

SR. NO	Course content	Hrs	% Weightage
1	**Introduction** Importance and applications of separation in chemical industries, Classification of separation processes, Basis of separation – physical and chemical properties, Selection criteria for separation methods, Units and dimensions in separation technology, Concept of separation efficiency, Introduction to equipment used in separation	10	25%

2	**Mechanical Separations** Filtration – principle, types, and applications, Centrifugation – working and applications, Sedimentation, Cyclone separators and hydro cyclones, Thickening and classification, Factors affecting mechanical separation	16	25%
3	**Thermal Separations** Distillation-Boiling point diagram and azeotropes, Evaporation – single and multiple effect, Crystallization, Drying, Industrial applications of thermal separation	18	30%
4.	**Mass based Separation Process** Absorption and stripping, Leaching, Adsorption – types and applications, Factors affecting diffusional separations, Selection of diffusional separation methods	16	20%
	Total	60	100%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	**Filtration and Centrifugation in Wastewater Treatment:** Present case studies of real-world fluid flow operations in industries such as petrochemicals, pharmaceuticals, or food processing. Discuss the design, operation, and optimization of fluid flow systems, highlighting practical challenges and solutions encountered in industry.	10
2.	**Distillation Column: Numerical** Students need to work on calculate the required number of theoretical plates using the McCabe-Thiele method, determine the reflux ratio, and analyze the energy consumption for the distillation process, considering factors like boiling point differences, equilibrium data, and column design specifications.	10
3.	**Comparison Techniques** Students will write a detailed report comparing different separation techniques such as distillation, adsorption, and membrane filtration, covering the theoretical principles, advantages, limitations, and industrial applications of each method	10
4.	**Multi-Stage Separation Process** Students are given a case study involving the separation of a complex mixture (e.g., a mixture of oil, water, and solids or a binary liquid mixture). Using the theoretical principles of separation (e.g., Raoult's Law, Fick's Law, or thermodynamic equilibrium) and Upload on GMIU portal.	10

5.	**Energy Efficiency in Separation Processes** Students are tasked with reviewing the energy consumption of various separation technologies, including membrane processes, evaporation, distillation, and centrifugation. They will analyze factors affecting energy demand, such as thermodynamic efficiency, mass transfer rates, and energy optimization through theoretical concepts like exergy analysis.	10
Total		50

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks **(Revised Bloom's Taxonomy)**						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	35%	25%	30%	10%	0%	0%

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.

Course Outcome:

After learning the course the students should be able to:	
CO1	Explain the basic principles and importance of various separation processes used in chemical industries
CO2	Select and apply suitable mechanical separation techniques such as filtration, centrifugation, and sedimentation for industrial applications.
CO3	Analyze and solve basic problems related to thermal separation operations like distillation, evaporation, drying, and crystallization.
CO4	Identify appropriate mass transfer-based separation techniques for specific chemical engineering applications.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Mass Transfer operations by Robert E. Treybal

[2] Introduction to Chemical Engineering by Badgers & Bancherow

[3] Chemical Engineering by Kolsen & Richardson

[4] Unit operations of Chemical Engineering by P. Chattopadhyay

[5] Hand book of Chemical Engineering by J H Perry.