Subject Code: 01CH0707

Subject Name: Advanced Separation Techniques

B.Tech. Year: IV (Semester VII)

Objective: To understand the governing mechanisms and driving forces of various advanced separation processes and to equip process and design parameters for advanced separation processes.

Credits Earned: 3 Credits

Course Outcomes: After completion of this course, student will be able to:

1. apply modern separation techniques in various applications
2. analyze and evaluate novel membranes for intended application
3. analyze and design pervaporation, chromatography and dialysis based separation processes
4. utilize the technological methods in problem solving in process plant.

Pre-requisite of course: Basic concepts of Mass transfer operations.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (I)	CSE (C)	Viva (V)	Term work (TW)	
3	0	0	3	50	30	20	25	25	150

CONTENTS:

Unit	Topics	Contact Hours
1	**Introduction:** Review of conventional processes, Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and equipment used in cross flow filtration, cross flow electro filtration, dual functional filter, Surface based solid - liquid separations involving a second liquid, Sirofloc filter.	10
2	**Membrane Separation:** Types and choice of membranes, Plate and frame, tubular, spiral wound and hollow fiber membrane reactors and their relative merits, Commercial, pilot plant and laboratory membranes permeators involving dialysis, reverse osmosis, Nanofiltration, ultrafiltration, Microfiltration and Donnan dialysis, Ceramic membranes.	10

3	**Separation By Adsorption Techniques:** Mechanism, Types and choice of adsorbents, Normal adsorption techniques, Affinity chromatography and immune chromatography. Types of equipment and commercial processes.	06
4	**Ionic Separations:** Controlling factors, Applications, Types of equipment employed for electrophoresis, Di-electrophoresis, Ion exchange chromatography and electro dialysis, Commercial Processes.	06
5	**Other Techniques:** Separations involving Iyophilisation, Pervaporation and permeation techniques for solids, liquids and gases. Industrial viability and examples, Zone melting, Addluctive crystallization, Supercritical fluid extraction, Oil spill Management, Industrial effluent treatment by modern techniques.	6
	Total Hours	**42**

REFERENCES:

1. Lacey, R.E. and S.Loaeb - " Industrial Processing with Membranes ", Wiley –Inter Science, New York, 1972.
2. King, C.J. " Separation Processes ", Tata McGraw - Hill Publishing Co., Ltd., 1982.
3. Schoew, H.M. - " New Chemical Engineering Separation Techniques ", Interscience Publishers, 1972.
4. Ronald W.Roussel - " Handbook of Separation Process Technology ", John Wiley, New York, 1987.

SUGGESTED THEORY DISTRIBUTION:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
10%	10%	30%	25%	25%	-

INSTRUCTIONAL METHOD:

a. 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.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

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

WEB LINKS:

1. https://nptel.ac.in/downloads/103105060/
2. https://separationtechniques.chemistryconferences.org/events-list/separation-processes-in-chemical-engineering
3. https://www.nap.edu/read/6388/chapter/4