

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
FIRST SEMESTER 2020-2021
Course Handout (Part II)

Date: 17/08/2020

In addition to part -I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	: CHE F313
Course Title	: SEPARATION PROCESSES II
Instructor-in-charge	:Balaji Krishnamurthy
Tutorial Instructors	:Balaji Krishnamurthy

1. Scope and Objective of the Course:

This course deals with chemical engineering unit operations which are used to separate solids from solids or solids from liquid or solids from gas in many of the chemical and pharma industries. These operations include size reduction followed by sieve analysis, mechanical separations such as filtration, crystallization, drying, adsorption, humidification and membrane separation process. There are many physical operations that are common to many industrial processes. Each of these processes is classified according to their function without regard to the industry. Each such operation is studied as a unit operation in this course.

2. Learning Outcomes:

- i. The students should be familiar and have gained some expertise with aspects of particulate solids and particle dynamics that is commonly encountered in chemical, ceramic, metallurgical, mining, pharmaceutical, food and biotechnology industries.
- ii. Since the course covers a large number of unit operations of Chemical Engineering, the students should attempt to solve mass transfer/separation based industry related issues in a confident and feasible manner with combination of conceptual, numerical and design based solutions learnt during the course of the semester.
- iii. The students should have learnt the skill of coupling micro and macro aspects of a separation process, to combine both materials and processes involved and to apply interdisciplinary skills of science and engineering in problem-solving.
- iv. Finally, the students should be comfortable and skillful in handling real-world case studies that they would encounter in their future endeavors of practice school, placements and higher education.

2. Text Book:

McCabe W. L., and Smith J. M., & Harriott P., *Unit Operations of Chemical Engineering*, Seventh Edition., McGraw-Hill International Edition, 2005.

3. Reference Books:

R1 *Mechanical Operations*, Anup Swain, Hemalatha Patra, GK Roy . McGraw Hill Education, 2011.

R2 *Separation Process Principles*, JD Seader and Ernest J. Henley, 2nd Edition, John Wiley & Sons, 2001.

R3 *Principles of Unit Operations*, Foust A. N. & others, 2nd Edition, John Wiley & Sons, 1980.

4. Course Plan:

Let.N o.	Learning Objectives	Topics to be covered	TB/Ref. Book
1.	Properties and Handling of particulate solids	Characterization of Solid particles, Particle size distribution, Screen analysis	Ch. 28 (TB)
2	Mixing of solids	Mixers for cohesive/non-cohesive solids	Ch. 28 (TB)
3-4	Size reduction	Size reduction, equipment for size Reduction, Ultrafine grinders	Ch. 28 (TB), Ch. 2 (R1)
5	Mechanical separation	Screening, screening equipment	Ch. 29 (TB), Ch. 5 (R1)
6-7	-do-	Filtration (Plate and frame filter press, rotary drum vacuum filtration, Centrifugal filters)	Ch. 29 (TB), Ch. 6 (R1)
8-9	-do-	Principles of cake filtration, Filtration calculations	Ch. 29 (TB)
10-11	-do-	Gravity sedimentation processes (clarifier, classifier and thickeners, flocculation)	Ch. 29 (TB)
12	-do-	Centrifugal sedimentation processes	Ch. 29 (TB)
13-14	Drying of Solids	Principles of Drying	Ch. 24 (TB), Ch. 18 (R1)
15-16	-do-	Cross circulation drying	Ch. 24 (TB)
17-18	-do-	Through circulation drying, Freeze drying, Drying equipment	Ch. 24 (TB)
19-21	Fixed Bed separation	Adsorption, adsorption equipment	Ch. 25 (TB), Ch. 15 (R2)
22-23	-do-	Ion-exchange	Ch. 25 (TB), Ch. 15 (R2)
24-25	-do-	Chromatography	Ch. 25 (TB), Ch. 15 (R2)
26-28	Membrane separation	Separation of gases	Ch. 26(TB), Ch. 14 (R2)
29-31	-do-	Separation of liquids (Dialysis, Pervaporation, Reverse osmosis)	Ch. 26 (TB)
32-33	Crystallization	Introduction, Crystal geometry, Equilibria, Super saturation	Ch. 27 (TB), Ch. 10 (R1), Ch. 17(R2)

34-37	-do-	Nucleation, Crystal growth & crystallization equipment and Crystallizer design	Ch. 27 (TB)
38-42	Lab tour	Ball mill, sieving, jaw crushing, sedimentation, blending/extrusion, sonication, high speed homogenizers, electrospinning, freeze drying, centrifugation, humidification and crystallization.	Notes

5. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Remarks
Test I	30min	15%	September 10 – September 20 (During scheduled class hour)	OB
Test II	30 min	15%	October 09 – October 20 (During scheduled class hour)	OB
Test III	30 min	15%	November 10 – November 20 (During scheduled class hour)	OB
Quizzes, Assignments	TBA	20%		OB
Comprehensive Exam	2 hours	35%	TBA	OB

7. Chamber Consultation Hour: To be announced later. **(Chamber: D 217)**

8. Notice: Notice will be displayed on Chemical Engineering Notice Board or CMS

9. Make-up policy: Make-up will be granted after he /she maintains minimum 60 % attendance in the class (Biometric attendance). Certificate from authenticated doctor from the Medical Center must accompany make-up application and follow the ID guidelines for midterm and compre exams.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
CHE F313