**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, K. K. Birla GOA CAMPUS**
**INSTRUCTION DIVISION**
**First Semester 2021-22**
**Course Handout (Part-II)**

**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** **: Richa Singhal**

**Instructors** **: Richa Singhal / Manjuri Kumar**

**Teaching Assistant** : Ishita

**Course Description:**
Most of the unit operations in chemical industries that are directed towards separating a substance into its component parts, like size reduction and screening, filtration, sedimentation, crystallization, drying, adsorption, ion exchange, chromatography, humidification, and membrane separation processes.

**Scope & Objective:**
To understand the fundamentals of chemical engineering operations. Usually most of the unit operations in chemical industries are directed towards separation of mixtures or purification. There are many physical operations that are common to many industrial processes. Each of these processes is classified according to their function with regard to the industry. Each such operation is studied as a unit operation. Some selected unit operations are dealt with in this course.

**Text Books:**

TB 1: McCabe W. L., and Smith J. C., & Harriott P., *Unit Operations of Chemical Engineering*, McGraw-Hill International Edition 2005, 7th Ed.

TB 2: R. E. Treybal –Mass Transfer Operations McGraw-Hill International Editions, 3rd ed, 1981

**Reference Books:**

R1: Coulson J. M., Richardson J. F. & others, *Chemical Engineering* (Volume 2), Pergamon Press, London, 2007, 5th Ed.

R2: Geankoplis C., Transport Processes & Unit operations, Prentice-Hall International, 3rd Edition.

R3: Seader, Henley, Roper, Separation Process Principles, John Wiley & Sons, 3rd Edition.

R4: Dutta, B.K., Principles of Mass transfer & separation processes, PHI Learning Pvt. Ltd., 2007.

R4: Foust A. N. & others, *Principles of Unit Operations*, John Wiley & Sons, 1980, 2nd Edition.

R5: Brown G. G. & others, *Unit Operations*, Chapman & Hall, 1950.

R6: Perry, R. H. (Ed.), *Chemical Engineers Handbook*, McGraw-Hill, New York (all editions).

**Course Plan:**

**Theory:**

| Lecture No. | Learning Objectives | Topics to be covered | Reference Chap. (Book) |
|---|---|---|---|
| 1-2 | Properties & Handling of particulate solids | Characterization of Solid particles, properties of masses of particles | Ch. 28 (TB 1) |
| 3-5 | -do- | Size reduction, equipment for size reduction | Ch. 28 (TB 1) |
| 6-7 | Mechanical separation | Screening, screening equipment, screen analysis | Ch. 29 (TB 1) |
| 8-9 | -do- | Filtration equipment | Ch. 29 (TB 1) |
| 10-11 | -do- | Filtration calculations | Ch. 29 (TB 1) |
| 12-14 | -do- | Gravity settling processes | Ch. 29 (TB 1) |
| 15 | -do- | Centrifugal sedimentation processes | Ch. 29 (TB 1) and Ch 9 R1) |
| 16-18 | Humidification | Humidity measurement | Ch. 19 (TB 1) & Ch 7 (TB 2) |
| 19 | -do- | Psychrometric chart | Ch. 19 (TB 1) & Ch 7 (TB 2) |
| 20 | -do- | Cooling towers | Ch. 19 (TB 1) & Ch 7 (TB 2) |
| 21-22 | Drying of Solids | Principles of drying, classification of dryers | Ch. 24 (TB 1) & Ch 12 (TB 2) |
| 23-24 | -do- | Heat transfer in dryers, drying equilibria | Ch. 12 (TB 2) |
| 25 | -do- | Drying equipment | Ch. 12 (TB 2) |
| 26-27 | Membrane separation | Introduction, Classification of membrane processes | Ch. 26 (TB1) |
| 28-30 | -do- | Membrane types, fabrication, transport in membranes | Ch. 26 (TB1) |
| 31 | -do- | Membrane modules | Ch. 26 (TB1) |
| 32-33 | Fixed bed separation | Adsorption | Ch. 25 (TB 1), Ch 11 (TB 2) & Ch 17 (R1) |
| 34-36 | -do- | Ion Exchange | Ch. 25 (TB1) |
| 37 | -do- | Chromatography | Ch. 25 (TB1) |
| 38-39 | Crystallization | Introduction, crystal geometry, equilibria, super saturation, | Ch. 27 (TB1) |
| 40 | -do- | Nucleation kinetics | Ch. 27 (TB1) |
| 41 | -do- | Crystal growth | Ch. 27 (TB1) |

**Evaluation Scheme:**

| EC No. | Component | Duration | Weightage (%) | Date and Time | Remarks |
|---|---|---|---|---|---|
| 1. | Continuous evaluation (Quiz/Assignment) | -- | 30 | Surprise/announced | CB/OB |
| 2. | Mid-Sem Examination | 90 min. | 30 | 16-10-2021, 11 AM-12.30 PM | CB |
| 3. | Comprehensive Exam | 120 min | 40 | 11-12-21 (AN) | CB |

**Make-up Policy**: No make-up will be given for quizzes and assignments under any circumstance. Make up for other components will be considered only in genuine cases (with proof). In all cases prior intimation must be given to IC.

**Notices:** All notices concerning this course will be uploaded on Moodle (quanta)/Google classroom.

**Dr. Richa Singhal**
**Instructor-in-charge**
**CHE F313**