Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021

Course Handout Part II

Date: 16-01-2021

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 F244**
Course Title : **Separation Processes I**
Instructor-in-Charge : **Dr. Satyapaul A. Singh**

Scope and Objective of the Course:

This course is designed to understand the mass transfer operations by applying the principles of molecular and interphase mass transfer. As a part of Separation Processes I, students apply the physical understanding about mass transfer operations and learn the design approach for absorption, distillation, extraction and leaching.

Content:

Molecular diffusion in fluids, Interphase mass transfer, mass transfer coefficient, Theories for interphase mass transfer, overall mass transfer coefficient and correlations, mass transfer with chemical reaction, analogy between momentum, heat and mass transfer, Absorption, Distillation including azeotropic and extractive distillation, Liquid-Liquid extraction, Leaching, Equipment for absorption, distillation, extraction and leaching.

Textbooks:

T1 – Robert E. Treybal, "Mass Transfer Operations", McGraw Hill, 3rd Edition (1981).
T2 – J. D. Seader and Ernest J. Henley, "Separation Process principles" John Wiley & Sons, Inc, 2nd Edition (2006).

Reference books:

R1 – Binay K. Dutta,"Principles of mass transfer and separation processes", PHI Learning Pvt Ltd, (2007).
R2 - McCabe, W. L., Smith, J. C., Harriott, P., "Unit Operations of Chemical Engineering", McGraw-Hill, 7th Edition, (2005).

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	Introduction to separation processes	Unit operations and unit process, Basic concepts	Ch. 1 T1,T2
2-5	Molecular diffusion in fluids	Molecular diffusion and fluxes, Molecular diffusion in Gases (stagnant film, equimolal counter diffusion), Diffusivity of gases and liquids.	Ch. 2, T1 Ch. 3 T2
6-14	Mass transfer coefficients, interphase mass transfer	Relations between mass transfer coefficients, Reynolds analogy. Equilibrium, diffusion between phases, material balances, stages.	Ch. 3, 5 T1 Ch. 3 T2
15-22	Gas absorption (Equipment for absorption)	Equilibrium solubility of gases in liquids, one component transfer: material balance for counter – and co-current processes, multi stage operations, non-isothermal operations, calculation of height of packed absorber/desorber, multi-component systems, absorption with chemical reaction.	Ch. 6T1
23-35	Distillation (Equipment for distillation)	Vapor-liquid equilibrium, flash vaporization, differential distillation, Continuous distillation, multistage columns, overall mass and enthalpy balances, McCabe-Thiele method, Ponchon-Savarit method, use of open steam, multiple feed, side streams, azeotropic and extractive distillations.	Ch. 9 T1 Ch. 7T2
36-39	Liquid extraction (Equipment for extraction)	Liquid-liquid equilibrium, distribution curves, triangular and solvent free coordinates, systems of three liquids-one pair partially soluble, insoluble liquids, effect of temperature, continuous counter-current multi-stage extraction, continuous counter-current extraction with reflux.	Ch. 10, T1
40-42	Leaching (Equipment for leaching)	Solid-liquid extraction, underflow and overflow locus, Multistage cross current extraction, Calculation of no. of stages for cross current flow.	Ch.13, T1

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Assignments (3)	(Will be discussed in Tutorial Sessions)	25	TBA	Open Book
Viva (1)	In regular lectures & tutorials	5	TBA	Open Book
MID	1.5 h	30	05/03 3.30 - 5.00PM	Open Book
Comprehensive Exam	2 h	40	15/05 AN	Open Book

Chamber Consultation Hour: Will be announced in the classroom (Chamber: **D 204**)

Notices: Will be updated in CMS

Make-up Policy: Make-up will be granted only for genuine cases with valid justification and only with prior permission of Instructor-in-charge.

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

Dr. Satyapaul A. Singh

INSTRUCTOR-IN-CHARGE
CHE F244