NIRMA UNIVERSITY
School of Engineering, Institute of Technology
B.Tech. in Chemical Engineering
Third Year/Semester V

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	3CH201CC24
Course Title:	Mass Transfer Operations-II
Course Type:	Core
Year of introduction:	2024-25

L	**T**	**Practical component**			
		LPW	**PW**	**W**	**S**
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. interpret the concepts of mass transfer operations (BL2)
2. apply the fundamentals of mass transfer operations (BL3)
3. analyse construction and working mechanism of mass transfer equipment (BL4)
4. solve the problems pertaining to mass transfer operations like distillation, humidification, adsorption, drying and crystallisation (BL6)

	Contents	**Teaching hours (Total 45)**
Unit I	**Distillation** Vapor-liquid equilibria, positive and negative deviation from ideality, steam distillation, differential distillation, continuous rectification, reflux ratio, theoretical stages: methods of McCabe-Thiele and Ponchon-Savarit, equipment for distillation, advanced distillation techniques.	**18**
Unit II	**Adsorption** Nature of adsorbents, adsorption equilibria, single stage operation, application of Freundlich equation, multistage cross-current and counter-current operation, breakthrough curve, ion-exchange, applications, equipment for adsorption operations.	**10**
Unit III	**Drying** Equilibrium curve, types of moisture, rate of batch drying, time of drying, types and equipment for drying operation.	**08**
Unit IV	**Humidification** Definitions, psychrometric chart, adiabatic saturation and wet-bulb temperatures, cooling towers.	**05**
Unit V	**Crystallisation** Solubility curves, mechanism and yield of crystallisation, equipment for crystallisation.	**04**

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on the above content of course.

Suggested Readings/References:

1. Treybal, R. E., Mass Transfer Operations, McGraw Hill, New York.
2. Coulson, J. M., Richardson, J. F., Backhurst, J. R., & Harker, J. H., Fluid Flow, Heat Transfer and Mass Transfer, Butterworth-Heinemann.
3. Cussler, E. L., Diffusion: Mass Transfer in Fluid Systems, Cambridge University Press.
4. Foust, A. S., Wenzel, L. A., Clump, C. W., Maus, L., & Andersen, L. B., Principles of Unit Operations, John Wiley & Sons.
5. Geankoplis, C. J., Transport Processes and Separation Process Principles, Prentice Hall Professional Technical.

L= Lecture, T=Tutorial, P= Practical, C=Credit

List of Experiments

Sr. No.	Practical	No. of Hours
1	To carry out differential distillation for binary liquid -liquid system and verify Rayleigh's equation.	02
2	To verify Freundlich's Isotherm equation for adsorption of dilute solution of acetic acid over activated charcoal and to observe the effect of temperature on adsorption rate.	02
3	To determine the percentage efficiency of crystallisation operation.	02
4	To generate drying rate curve for a batch drying test of a given material.	02
5	To study the operation of a bubble cap distillation column.	02
6	To study the operation of a packed bed distillation column.	02
7	To study the operation of a sieve plate distillation column.	02
8	To study humidification operation and to calculate all the properties of air-water system.	02
9	To study the performance of a Cooling tower.	02
10	To study the characteristics of Steam distillation and Vacuum distillation	02