

Course Type	Course Code	Name of the Course	L	T	P	Credits
ESC	NCHE101	Unit Operations and Unit Processes	3	0	0	3

Course Objective

Unit operations and unit processes are a series of primary and common steps used in large-scale chemical, physical, or biological production plants. The course aims to impart knowledge of basic concepts and design of unit operations and processes to chemical and other engineering students.

Learning Outcomes

Upon completing the course, students will be able to appreciate the underlying concepts of the physical and chemical processes and working principles of commonly used devices in the process industries for treating raw materials and product purification, including mixing, reaction, and separation.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction: A brief introduction to chemical engineering and process industries – upstream and downstream processes, reactors, and their applications.	3	Understanding the objective and requirements of the process industry for producing value-added products.
2	Preparation of Raw Materials: Size reduction; particle-size distribution and measurement. Equipment for size reduction – crusher, grinder, ball mill, etc. Power required in size reduction.	8	Students will appreciate the need to prepare solid materials before using for further processing.
3	Mixing: Mixing of fluids (blending), Types of blenders, Energy input in fluid mixing, Mixing of solid particulate, Homogenization.	4	Understanding the mixing of various types of materials needed for processing
4	Separation: Filtration, Sedimentation, Thickening, Evaporation, Flotation, Leaching and Extraction, Distillation, Absorption with and without Chemical Reaction.	12	Acquaintance with the principles and design of various devices/units used for the separation of different types of mixtures
5	Heat exchanger: Concepts of conduction and convection, double-pipe heat exchanger, LMTD, shell-and-tube heat exchanger.	5	Students will learn theories of heat transfer and how heating, cooling, and heat recovery are achieved in process industries.
6	Reacting systems: Introduction to Homogenous and Heterogenous reactions, order and rate of reaction, Ideal reactors (CSTR and PFR). Temperature control, Multiple steady states, and run-away reactions.	10	Students will understand concepts of simple reactor design and operational issues.

Textbooks:

1. Geankoplis, C. J. (1993). Transport Processes and Unit Operations. 3rd edition, Prentice Hall.
2. Levenspiel, O. (2006). *Chemical reaction engineering.*, 3rd Edition, Wiley India Pvt. Limited.

Reference Books:

1. McCabe, W. L., Smith, J. C., & Harriott, P. (2017). *Unit operations of chemical engineering*, 7th edition, McGraw-Hill.
2. Harriott, P. (2002). *Chemical reactor design*. CRC Press.

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