

Course Learning Objectives (CLO) and Course Outcomes (CO)

B.E. Chemical Engineering

UCH101 INTRODUCTION TO CHEMICAL ENGINEERING

Course Objective:

To introduce history, importance and components of chemical engineering, concepts of unit operations and unit processes, and current scenario of chemical & allied process industries.

Course Outcome:

- Understanding of chemical engineering and its relation to other disciplines
- Ability to list chemical processes, units, and the corresponding equipments
- Awareness of career options, potential job functions, contemporary and professional issues.
- Familiarity with computer applications in process industries

UCH301 MATERIAL AND ENERGY BALANCES

Course Objective:

To understand and apply the basics of calculations related to material and energy flow in the processes.

Course Outcome:

- Ability to make material balances on unit operations and processes
- Ability to perform simultaneous material and energy balances
- Understanding of the degrees of freedom analysis and its significance
- Understanding of the concept of humidity and usage of psychrometric chart

UCH302 PROCESS FLUID MECHANICS

Course Objective:

To understand basic concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery and agitation & mixing.

Course Outcome:

- Knowledge of basic principles of fluid mechanics
- Ability to analyze fluid flow problems with the application of the momentum and energy equations
- Capability to analyze pipe flows as well as fluid machinery

UCH303 CHEMICAL ENGINEERING THERMODYNAMICS

Course Objective:

To understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state, methods used to describe and predict phase equilibria.

Course Outcome:

- Ability to apply fundamental concepts of thermodynamics to engineering applications
- Ability to estimate thermodynamic properties of substances in gas and liquid states
- Capability to determine thermodynamic efficiency of various energy related processes

UCH401 FLUID AND PARTICLE MECHANICS

Course Objective:

To understand basic principles of various mechanical operations, construction and working of the equipments.

Course Outcome:

- Ability to understand fluid particle systems and equipment
- Ability to select suitable size reduction equipment, solid-solid separation method and conveying system
- Ability to analyze mixing processes
- Understanding of fluid flow through packed and fluidized beds

UCH402 HEAT TRANSFER

Course Objective:

To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

Course Outcome:

- Ability to understand and solve conduction, convection and radiation problems
- Ability to design and analyze the performance of heat exchangers and evaporators
- Ability to design and analyze reactor heating and cooling systems

UCH403 CHEMICAL PROCESS INDUSTRIES

Course Objective:

To study process technologies of various organic and inorganic process industries.

Course Outcome:

- Ability to understand the manufacturing of various inorganic and organic chemicals
- Ability to understand the process flow diagram and various process parameters
- Ability to identify and solve engineering problems during production

UCH404 ENERGY RESOURCES

Course Objective:

To study various types of conventional and non-conventional energy resources including solid, liquid and gaseous fuels.

Course Outcome:

- Knowledge of solid, liquid and gaseous fuels
- Knowledge of characterization techniques for fuels
- Knowledge of alternate energy sources

UCH501: CHEMICAL REACTION ENGINEERING-1

Course Objectives: To apply knowledge from calculus, differential equations, thermodynamics, general chemistry, and material and energy balances to solve reactor design problems, To examine reaction rate data to determine rate laws, and to use them to design chemical reactors, To simulate several types of reactors in order to choose the most appropriate reactor for a given need, To design chemical reactors with associated cooling/heating equipment.

Course Outcomes:

- Develop rate laws for homogeneous reactions
- Design of ideal reactors for single and complex reactions
- Develop skills to choose the right reactor among single, multiple, recycle reactor, etc. schemes.
- Design of non-isothermal reactors and the heat exchange equipment required.

UCH502: MASS TRANSFER-I

Course Objectives: The purpose of this course is to introduce the undergraduate students with the most important separation equipments in the process industry, and provide proper understanding of unit operations.

Course Outcomes:

- Students will learn about the diffusional mass transfer
- Operation of cooling tower will be clearly understood
- Operation of Dryer will be understood
- Student will understand the mechanism of crystallization and absorption

UCH503: INDUSTRIAL POLLUTION ABATEMENT

Course Objective: The aim of this course is that the students will learn the essential principles used in industrial pollution abatement and understand important issues in industrial pollution abatement and pertinent environmental legislations.

Course Outcomes

- Understand the different types of wastes generated in an industry, their effects on living and non-living things.
- Understand environmental regulatory legislations and standards and climate changes.
- Understand about the quantification and analysis of wastewater and treatment.
- Understand the different unit operations and unit processes involved in conversion of highly polluted water to potable standards.
- Understand the atmospheric dispersion of air pollutants, and operating principles, design calculations of particulate control devices.
- Understand about analysis and quantification of hazardous and nonhazardous solid waste wastes, treatment and disposal.

UCH504: ENERGY TECHNOLOGY

Course Objectives

To understand processing and limitations of fossil fuels (coal, petroleum and natural gas) and necessity of harnessing alternate energy resources such as solar, wind, nuclear, geothermal, tidal and biomass. Also, to understand and practice various characterization techniques for fuels.

Course Outcomes:

- To know the energy demand of world, nation and available resources to fulfill the demand
- To know about the conventional energy resources and their effective utilization
- To acquire the knowledge of modern energy conversion technologies
- To be able to understand and perform the various characterization techniques of fuels
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively.

UCH505: PROCESS EQUIPMENT DESIGN-I

Course Objectives: The objective of this course is to acquire basic understanding of design parameter, complete knowledge of design procedures for commonly used process equipment and their attachments (e.g. internal and external pressure vessels, tall vessels, high pressure vessels, supports etc.), and different types of equipment testing methods.

Course outcomes

- Knowledge of basics of process equipment design and important parameters of equipment design
- Ability to design internal pressure vessels and external pressure vessels
- Ability to design special vessels (e.g. tall vessels) and various parts of vessels (e.g. heads)
- Knowledge of equipment fabrication and testing methods

UCH506: PROCESS INSTRUMENTATION AND CONTROL

Course Objectives: To gain the knowledge of different process instruments, To understand dynamic modeling of a physical process using first principles, To convert the model to a form amenable to solution and analysis, To design various control schemes, and To apply the control system in various processes.

Course Outcomes:

- Knowledge of field instrumentations
- Dynamic modeling and system behavior study
- Design of controllers
- Application of control systems in processes

UCH601: CHEMICAL REACTION ENGINEERING-1I

Course objectives: To apply the knowledge of material and energy balances, mass transfer and chemical reaction engineering–I for solving problems involving heterogeneous reaction systems and to understand and apply the principles of non-ideal flow in the design of reactors.

Course Outcomes:

- Ability to distinguish between various RTD curves and predict the conversion from a non-ideal reactor using tracer information.
- Develop rate laws for heterogeneous reactions
- Design of reactors for non-catalytic and catalytic reactions.
- Design of towers for gas–liquid operations with and without chemical reaction.

UCH602: MASS TRANSFER-II

Course Objectives: To teach the students different separation techniques. At the end of the study students will come to know the design of a distillation column, as well as design of an adsorber and calculations involved in liquid-liquid extraction and solid-liquid extraction.

Course Outcomes:

- Design calculation of distillation column
- Separation by adsorption and design of adsorber, chromatographic separation
- Separation by liquid-liquid extraction
- Separation by leaching

UCH603: TRANSPORT PHENOMENA

Course Objective:

This course will provide the fundamentals to solve real-life problems involving transports of momentum, energy and mass in biological, mechanical and chemical systems using a unified approach.

Course Outcomes

- Understanding of transport processes.
- Ability to do heat, mass and momentum transfer analysis.
- Ability to analyze industrial problems along with appropriate boundary conditions.
- Ability to develop steady and time-dependent solutions along with their limitations.

UCH604: BIOCHEMICAL ENGINEERING

Course objective:

To enhance skills in the areas of biochemical processes, to provide the fundamental background of biological systems, bio-chemical engineering, environmental engineering, advanced bioprocess engineering, biologically mediated processes and waste treatment.

Course Outcomes:

- Understanding of biological basics and bioprocessing
- Understanding the difference between bioprocesses and chemical processes
- Bioprocess design and operation
- Choice of bioreactor
- Heat & mass transfer considerations and scale up of bioprocesses
- Introduction to bioprocess monitoring/control

UCH605: PROCESS UTILITIES AND INDUSTRIAL SAFETY

Course Objective:

This course will provide effective use of chemical industries utilities. This course also emphasizes on the knowledge of loss prevention, personal safety, industrial safety, hazard analysis, toxicology and personal protective equipments.

Course Outcomes

- Understanding of Safety principles.
- Ability to do Hazard analysis.
- Ability to do event tree and fault tree analysis.

UCH 606: PROCESS EQUIPMENT DESIGN II

Course objectives: The aim of this course is to give up-to-date knowledge for designing the process equipment such as heat and mass transfer equipment used in chemical process plants.

After undergoing this course the students will have the knowledge to analyze a problem and finding a process design method for heat and mass transfer equipment used in chemical plants especially in heat exchangers and distillation columns.

Course Outcomes:

- Able to process design of shell & tube heat exchanger.
- Able to process design of plate heat exchanger.
- Able to process design of sieve tray distillation column.
- Able to process design of packed bed distillation column.

UCH701: CATALYTIC PROCESSES

Course Objective: To make the student understand the properties of catalyst and mechanism of catalytic reactions for the design of processes involving catalytic reactions.

Course Outcomes:

- Understanding of various catalysts and the role of catalyst in chemical reactions.
- Knowledge of catalyst preparation and characterization methods.
- Knowledge of heat and mass transfer effects on catalytic reactions.
- Ability to design different types of reactors for conducting catalytic reactions.

UCH715: ALTERNATE ENERGY SOURCES

Course Objectives

To understand and analyze the present and future energy demand of world and nation and techniques to exploit the available renewable energy resources such as, solar, bio-fuels, wind power, tidal and geothermal effectively.

Course Outcomes:

- To know the energy demand of world, nation and available resources to fulfill the demand
 - To know about the exploration of nonconventional energy resources and their effective tapping technologies
- Effective utilization of available renewable energy resources
- To acquire the knowledge of modern energy conversion technologies

UCH721: FOOD TECHNOLOGY

Course Objectives: To impart knowledge to the students about food processing and various unit operations involved in it, packaging, storing and preservation, food poisoning, food related hazards and safety, and transportation.

Course Outcome

- Understanding the various causes of food deterioration and food poisoning.
- Identification of appropriate processing, preservation, and packaging method.
- Analyze product quality and effect of processing technique on it.
- Identify important species of pathogenic microbes and describe factors that affect their growth in various types of food.
- Analysis of food related hazards and HACCP method.

UCH801: PROCESS ENGINEERING AND PLANT DESIGN

Course objective: To understand the basic concepts of flow sheeting, material and energy balances and process development, To apply algorithms for feasibility and optimization of flow

sheet, To gain knowledge of estimation of capital investment, total product costs, depreciation, cash flows, and profitability, To carry out process optimization based on economic profitability by connecting economics with design principles for real chemical engineering processes.

Course Outcomes:

- Understand concepts of process design and project management
- Synthesize feasible and optimum flow-sheet
- Estimation of capital investment, total product costs, and profitability.
- Optimum design of equipments based on economics and process considerations.

UCH 802: PROCESS MODELING AND SIMULATION

Course Objectives: To make the students understand physical systems in chemical engineering and to develop their mathematical models and solutions for these models. The students will also learn to use the commercial process simulators.

Course Outcomes

- Understand the important physical phenomena from the problem statement
- Develop model equations for the given system
- Demonstrate the model solving ability for various processes/unit operations
- Demonstrate the ability to use a process simulation

UCH 835: PROCESS OPTIMIZATION AND STATISTICAL ANALYSIS

Course Objectives: The primary goal of this course is to provide an overview of state-of-the-art optimization algorithms, the theoretical principles that underpin them, and to provide students with the modelling skills necessary to describe and formulate optimization problems and their use for solving several types of practically relevant optimization problems arising in process systems engineering.

Course Outcomes:

- Identify different types of optimization problems
- Understanding of different optimization technique
- Ability to solve various multivariable optimization problems
- Ability to solve optimization using software tools.
- Identify different types of test of Hypotheses.
- Ability to solve problems by using least square analysis.
- Understand Correlation and Regression

UCH836: ENERGY MANAGEMENT IN PROCESS INDUSTRIES

Course objectives: To understand the principles associated with effective energy management and to apply these principles in the day-to-day life. To gain exposure to energy auditing, to identify energy conservation opportunities in various industrial processes and to evaluate the performance of boilers, furnaces and other energy intensive equipment/processes.

Course Outcomes:

- Understanding of energy conservation and identification of energy conservation opportunities in various industrial processes
- Knowledge of various tools and components energy auditing
- Ability to evaluate the performance of industrial boilers, furnaces etc. by direct and indirect methods

- Understanding of cogeneration in industry and waste heat recovery techniques and devices

UCH841: CORROSION ENGINEERING

Course objective: To introduce the principles of corrosion, common corrosion forms, corrosion control methods, and material selection to reduce corrosion cost.

Course outcomes:

- Ability to understand electrochemical fundamentals
- Ability to understand corrosion preventing methods
- Ability to understand environmental induced corrosion
- Ability to corrosion problems

UCH842: NANOFLUID ENGINEERING

Course objective: To introduce the application of nanotechnology in the area of fluids and thermal engineering.

Course outcomes:

- Understanding of superior thermophysical properties of nanofluids
- Understanding of synthesis of nanofluids
- Comparison of heat transfer using nanofluids with conventional fluids
- Understanding of convection and boiling heat transfer
- Research on this new topic to design modern mini and microchannel heat exchangers with nanofluids exhibiting much higher thermal efficiency and saving energy.

UCH844: PETROLEUM TECHNOLOGY

Course objectives: Studying this subject the students will learn about the extraction and production of oil and gas to meet energy needs, as well as refining of crude oil for a wide spectrum of useful products such as petrochemicals, Chemicals, Plastics.

Course Outcomes:

- Introduction with the petroleum refinery worldwide
- Develop knowledge of different refining processes
- Develop knowledge of safety and pollution control in the refining industries.
- To find the suitable refining technology for maximizing the gasoline yield

UCH845: POLYMER TECHNOLOGY

Course objectives: To provide a broad and fundamental knowledge of the polymers and their chemical, physical and mechanical behavior. Emphasis is on the processing techniques, along with the production of polymers. Towards the end, the student should be able to correlate structure-processing-properties relationships for polymers, blends and composites including nanocomposites.

Course Outcomes:

- Understand the techniques and their characteristics/limitations of synthesis of polymers.
- Understand the structure-processing-property relationship of polymers.
- Understand and apply the various processing and manufacturing techniques.
- Understand the basic issues involved in polymer blends, composites and nanocomposites.