

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 1**

**Subject:** PS01CICH 28- Industrial Management & Industrial Psychology

**Faculty:** Dr. Rohit Dave

#### **Course Description**

The course introduces management practices in the industry. The course provides important information regarding financial management, Marketing management, Operational management and Human resource management. Managerial function is also supported by Industrial psychology. Industrial psychology course provides information about psychological fundamental like stress, attitude, organizational behaviour, morale, motivation and fatigue.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to

- Understand the basic concepts and laws of various management concepts.
- Managerial skill development
- Understand marketing skill and policy document preparation.
- Understand balance sheet, cost statement and profit and loss.
- Capable to manage human resources in the industry
- Understand human psychology at work.
- Understand the attitude, morale and stress limit of the employee.

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 1**

**Subject:** PS01CICH29- Mass Transfer Operations

**Faculty:** Dr. Mandar Karve

#### **Course Description**

The course provides an introduction to mass transfer and introduces practical application in industry. Basic tools to design process operations involving mass transfer are covered. Extensive use is made of industrial examples and analogies between the various transport mechanisms to encourage lateral thinking.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to

- Apply principles of diffusion & mass transfer to basic engineering systems
- Analyse various mass transfer systems
- Understand the construction & working of various equipment used in distillation, extraction, leaching, drying, absorption and filtration.
- Analyse and design plate & packed columns for distillation, mixer-settlers and RDC for extraction, packed column absorber, batch & continuous driers, Constant rate & constant pressure filters

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 1**

**Subject:** PS01CICH30: Industrial organic chemistry

**Faculty:** Dr. Arunabh Mishra

#### **Course Description**

The course provides basic information about types of chemical reactions, homolytic and heterolytic fission, nucleophilic and electrophilic reactions, carbanion and carbonium ions. Preparation, properties and applications of reagents used in organic synthesis. The principle, reaction mechanism and application of various name reactions. Synthesis, properties and uses of important chemicals and solvents used in chemical process industries.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to

- Have basic knowledge of fission and fusion.
- Understand the electrophilic and nucleophilic reactions.
- Understand the addition, substitution, replacement and rearrangement reactions.
- Knowledge of important reagents used in chemical industries.
- Understand the reaction mechanism of various name reactions.
- Commercial manufacturing process technology of various chemicals and solvents.

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 1**

**Subject:** PS01EICH 23- Technology of Oleochemicals and Surfactants

**Faculty:** Dr. Jigar V. Patel

#### **Course Description**

The course provides an overview of oleo chemical industries and introduces the students regarding the fundamentals of various basic oleo chemical production technology viz. fatty acids, fatty esters, fatty alcohols and fatty amines and their applications in the development of various value-added products. The course also introduces the theory of surfactant behaviour and commercial production technology of important surfactants of various classes viz. anionic, cationic, non-ionic and amphoteric.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to

- Understand the importance of Vegetable and animal fats and oils as a renewable source of chemicals
- Analyse the suitability of various oils for oleo chemical production
- Understand the industrial processes for various oleo chemical productions.
- Understand the role of oleo chemicals in development of various value-added products viz. fuels, lubricants and agrochemicals
- Understand the basic theory behind the behaviour of surfactants
- Understand how to select a particular surfactant for a particular application
- Analyse the role of surfactant in various value-added applications like detergency, adhesives, surface coatings, petroleum, pharmaceuticals etc.
- Understand the important industrial processes for surfactant production

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 2**

**Subject:** PS02CICH28- Unit processes

**Faculty:** Dr. Arunabh Mishra

#### **Course Description**

The course provides basic information about the unit operation and unit processes. The course covers the concept of various unit processes like halogenations, alkylation, oxidation, hydrogenation, nitration, sulfonation, esterification, hydrolysis and hydration. Synthesis based on carbon monoxide and hydrogen.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand the basic concepts of unit operation and unit process.
- Understand the reaction mechanism, kinetics and thermodynamics of unit processes.
- Gain knowledge about raw materials, agents and reaction conditions required to carry out the specific unit process.
- Knowledge of material of construction
- Understand the safety and hazard criteria related to unit processes.
- Understand the concept of Fischer tropesch and oxo synthesis.

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 2**

**Subject:** PS02CICH29 - Heat transfer operations and Stoichiometry

**Faculty:** Dr. Mandar Karve

#### **Course Description**

The first part of the course aims to introduce basic concepts and principles of heat transfer encountered in chemical process industries. It covers analytical, empirical and numerical techniques for the solution of heat transfer problems.

The second part of the course introduces the concept of stoichiometry, mass, energy balances, and other fundamental aspects of chemical engineering.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand the basic concepts and laws of the three modes of heat transfer;
- Understand and use empirical equations to solve forced and natural convection heat-transfer problems;
- Solve simple radiation heat transfer problems;
- Analyse the heat transfer processes involved in boiling and condensation;
- Design common heat exchangers like double pipe and shell & tube to determine relevant design parameters
- Identify and understand the unit operations involved in a process
- Solve materials and energy balances alone and simultaneously on chemical process systems

**M.Sc.-Industrial Chemistry**  
**Course Description and Learning Outcome**

**SEMESTER - 2**

**Subject:** PS02CICH 30 - Petrochemical Technology

**Faculty:** Dr. Jigar V. Patel

**Course Description**

The course introduces the crude petroleum and natural gas as a resource for energy production and chemical production. It also includes the technologies of petroleum refining and processing to obtain the more valuable lighter fractions and intermediates for petrochemicals.

Other portion of the course deals with the production technologies of various important petrochemicals from various saturated, unsaturated and aromatic hydrocarbons obtained from petroleum.

**Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand the importance of crude petroleum as a resource for energy and chemicals
- Understand the chemical composition of natural gas and crude petroleum and learns the common analytical techniques to evaluate the quality of a crude oil
- Understand the commercial processes used for the refining and processing of natural gas and crude petroleum
- Understand the commercial production technology of various important petrochemicals

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 2**

**Subject:** PS02EICH24 - Air Pollution Control Technology

**Faculty:** Dr. Rohit Dave

#### **Course Description**

The first part of the course aims to introduce various source of air pollution. It covers a different type of air pollution like natural and anthropogenic, vehicle pollution, aeroallergens

The course also covers various standard of air, environmental factors like heat, wind, precipitation, mixing height, topography. It covers the prevention and control of pollution with case studies. Different types of analytical and statistical method to measure air pollution are also covered under the course.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand the basic concepts of air pollution.
- Understand the different type of air pollution and their sources.
- Understand various environmental factors that affect air pollution.
- Analyse the different type of model to understand air pollution.
- Educated in various measurements and monitoring techniques of air pollution.
- Understand some of the serious outcomes of an unmanaged air pollution incident.
- Educated in statistical method to monitor and analyses air pollution.

## M.Sc.-Industrial Chemistry

### Course Description and Learning Outcome

#### SEMESTER - 3

**Subject:** PS03CICH28 - Spectroscopy & Instrumental Techniques

**Faculty:** Dr. Rohit Dave

#### **Course Description**

The course is divided into four units. The first unit highlight on IR and NMR spectroscopy. The knowledge of IR and NMR spectroscopy helps to identify an unknown compound. It covers principle, theory and application of spectroscopy. The second unit comprises an introduction, principle and application of mass spectroscopy.

The third unit covers instrumentation of HPLC, explains the various application of it. The four-unit covers the introduction and instrumentation of TGA, DTA, DSC, XRD and SEM. It also covers various applications of all instruments.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand the basic of spectroscopy
- Understand theory, principle and application of various analytical techniques like IR, NMR, Mass Spectroscopy that help to examine the effect of the energy of particular spectral range.
- Analyse sample with the best utilization of technology that provides structural information.
- Understand stereoisomer, bonding and a special arrangement of molecules, Examine molecular weight and their probable cleavage.
- Understand separation techniques for the purification of the organic mixture.
- Identification of impurities and purities of sample and method development for the specific compound in nature.
- Educate in structure identification, topology, morphology, composition and crystallographic information by using XRD and SEM.
- Understand the effect of heat on the easily degradable compound.
- Analyse melting point, type of reaction like endothermic or exothermic.

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 3**

**Subject:** PS03CICH29 - Process Safety Management and transportation of fluids

**Faculty:** Dr. Mandar Karve

#### **Course Description**

The first part of the course emphasises on the knowledge of loss prevention, personal safety, industrial safety, hazard analysis and various elements of process safety management

The second part of the course aims to cover the basic concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery and agitation & mixing.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand and design safe systems for unit operations & unit processes
- Understand thoroughly all 14 elements of PSM
- Understand and analyse hazop, fault tree and DOW F & EI
- Analyse fluid system and design pumps
- apply concepts of mass, momentum and energy conservation to flows
- Undertake basic design calculations of fluid engineering systems
- Understand and articulate the principles that are in operation in the range of fluid motive and flow measuring devices.
- Understand the basic principle behind various mixers used in chemical industries and their selection in respective applications

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 3**

**Subject:** PS03CICH 30 - Pharmaceutical technology

**Faculty:** Dr. Jigar V. Patel

#### **Course Description**

The course introduces various pharmaceutical dosage forms, their merits and demerits along with the technology for their production at the industrial scale. The course also highlights various important regulations like GMP and GLP practised in the pharmaceutical industry.

#### **Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand various types of pharmaceutical dosage forms viz. solid, semi-solid, liquid and advanced drug delivery systems
- Understand thoroughly tablet and capsule production at commercial scale
- Understand the importance of various regulations viz. GMP, GLP and validation in the pharmaceutical industry and become familiar with these guidelines
- Understand how to implement and work as per GMP, GLP guidelines in the pharma industry

**M.Sc.-Industrial Chemistry**  
**Course Description and Learning Outcome**

**SEMESTER - 3**

**Subject:** PS03EICH24- Processing of oils and fats to utility products

**Faculty:** Dr. Arunabh Mishra

**Course Description**

The first part of the course covers the principle, kinetics, thermodynamics and optimum conditions for hydrogenations. Manufacture and utilization of products obtained from edible oil blends. Manufacture and uses of peanut butter  
The second part of the course covers the manufacturing technology of soap and detergent. The course provides basics information about various oils and additives used for the manufacture of soap and detergents.

**Learning Outcomes/Capability Development**

At the completion of this course, students should be able to:

- Understand the technology of hydrogenation
- Understand commercial manufacturing of hydrogen
- Basic information about edible and non-edible oil
- Understand the detergency, surfactants
- Understand the technology of soap and detergent manufacturing.
- Selection of oils for utilization of other edible products.
- Understand the manufacture of butter, ghee, mayonnaise, peanut butter etc.

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 4**

**Subject:** PS04CICH27 - Introduction to reaction engineering and steam generation

**Faculty:** Dr. Mandar Karve

#### **Course Description**

The first part of the course aims to apply knowledge from 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, and to choose the most appropriate reactor for a given need

To study the basics of global reaction rate for heterogeneous reaction systems, construction & working of 3-phase reactors, BET method for determination of surface area, Helium-Mercury method for porosity determination

The second part of the course covers various types of steam, factors to be considered in designing a steam generator, calculations involving boiler such as heat supply required, boiler efficiency, boiler power etc.

#### **Learning Outcomes/Capability Development**

- 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 schemes.
- Design Slurry & Trickle bed reactors for 3 phase reactions
- Calculate surface area, porosity and pore distribution for catalysts
- Understand the usage of steam tables
- Calculate boiler thermal efficiency & power

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 4**

**Subject:** PS04CICH28- Process Development in Chemical Industries

**Faculty:** Dr. Jigar V. Patel

#### **Course Description**

The first part of the course aims to introduce the fundamentals of process development in chemical industries including its goals, stages, scopes and limitations

The second part of the course includes the topics related to the role of various parameters in the development of a particular chemical process

#### **Learning Outcomes/Capability Development**

- Basic knowledge of chemical process development principles
- Understanding of various parameters affecting chemical process development
- Development of skill to develop a chemical process for various chemical reactions.

**M.Sc.-Industrial Chemistry**  
**Course Description and Learning Outcome**

**SEMESTER - 4**

**Subject:** PS04CICH29 - Technology of Chemical Process Industries

**Faculty:** Dr. Arunabh Mishra

**Course Description**

The first part of the course covers the history, classification and application of pigments. The course provides information about manufacture and applications of various binders and resins used in surface coating industries. The course covers the classification of solvent and solvent ratings, various additives used in the surface coating industry.

The second part of the course covers the technology of fertilizers like urea, ammonium nitrate, ammonium sulphate, potassium sulphate etc. It also covers the technology of various agrochemicals

**Learning Outcomes/Capability Development**

- Understand the application and technology of pigments
- Understand the role and need for binders in surface coating.
- Gain knowledge of the technology of various resins like alkyd, polyester, amino, phenolic, epoxy, polyester etc.
- Understand the need for solvent and solvency rating.
- Sound knowledge about fertilizer and agrochemical industries.

## **M.Sc.-Industrial Chemistry**

### **Course Description and Learning Outcome**

#### **SEMESTER - 4**

**Subject:** PS04EICH23- Advanced Analytical Chemistry

**Faculty:** Dr. Rohit Dave

#### **Course Description**

The course provides exposure to the advances in the field sophisticated instrumentation with special emphasis on principle, working and application. The first unit covers the application of Raman spectroscopy that helps to deduce the structure of an unknown compound.

The second unit covers Inductively coupled plasma spectroscopy for the determination of impurity in pharmaceutical products, food products, herbal medicine, beverages and drinking water.

The third unit covers an introduction to TEM, instrumentation and application in the analysis of topology, morphology, composition and crystallographic information.

The fourth unit covers theory, principle and applications of the particle size analyser.

#### **Learning Outcomes/Capability Development**

- Understand theory, principle and application of various advanced analytical techniques like ICP, TEM, and Raman spectroscopy and a particle size analyzer.
- Analyse sample with the best utilization of technology that provides structural information.
- Understand vibration phenomena of molecular when subject to infrared radiation, Understand the bonding of molecules and stereoisomer.
- Educate in structure identification, topology, morphology, composition and crystallographic information by using XRD and SEM.
- Educate in Theory and practice of light scattering.
- Information regarding sampling, sample preparations, and sample dispersion techniques.