

# Swami Ramanand Teerth Marathwada University, Nanded



**B. O. S. In Chemistry**  
**B. Sc. First Year Semester I & II**  
**Industrial Chemistry**  
**Syllabus**  
In force from June – **2013**

## B. Sc. First Year (Semester-I)

### Industrial Chemistry

Paper	Course No.	Course Name	Periods/week	Periods	Marks
I	CHIC-101	Unit Operations-I	3	45	50
II	CHIC-102	Process Calculations -I	3	45	50

## B. Sc. First Year (Semester-II)

### Industrial Chemistry

Paper	Course No.	Course Name	Periods/week	Periods	Marks
III	CHIC-103	Unit Operations-II	3	45	50
IV	CHIC-104	Process Calculations-II	3	45	50
V	CHIC-105	Laboratory Course-I	4	120	100

Theory papers Marks 60: (External 50 + Internal 10)

**B. Sc. First Year Semester-I  
Industrial Chemistry**

**Paper – I, Unit operations-I (CHIC-101)**

**Periods: 45**

**UNIT-I**

**Fluid Mechanics-I: 10P**

**1.1 Flow of Fluids:** Definitions of fluids, Classification of fluids, Properties of fluids, Fluid Pressure, Pressure Head, Hydrostatic equilibrium for compressible and incompressible fluids.

**1.2 Application of fluid statics:** Manometers, U-tube manometer, Inclined Manometer, Differential Manometer, Continuous gravity decanter.

**Unit-II**

**Fluid Mechanics-II: 10P**

**2.1. Fluid Flow Phenomena:** Types of flow, Laminar flow, Shear Rate and Shear Stress, Turbulence-Reynolds number & Transition from Laminar to Turbulent flow, Reynolds experiment, Boundary layers, Flow in boundary layers, Laminar and Turbulent flow in boundary layers.

**UNIT-III**

**10P**

**3.1. Basic Equations of fluid flow:** Equation of Continuity, Bernoulli's equation, Pump work in Bernoulli's equation and its application.

**Unit-IV**

**4.1. Transportation and Metering of fluids: 15P**

Transportation of fluids: Pipe, Tubing, Fittings & valves. Pumps: Classification of Pump, Developed head, Power requirement, Suction lift and cavitations, Positive- displacement pumps, Reciprocating pumps, Rotary pumps, Centrifugal pumps, Centrifugal pump theory, Ideal pump, Actual pump performance, Power consumption, Efficiency. Air Binding and Pump Priming, Losses in Centrifugal Pump, Centrifugal Pump troubles & Remedies, Pump fails to start pumping, Pump is working but not up to the capacity and pressure, Pump starts and then stop pumping, Pump takes too much power.

Metering of fluids: Full bore meters- Principle, Construction and Working, Advantages and Disadvantages of Venturimeter , Orificemeter , Pitot Tube, Rotameter.

**B. Sc. First Year Semester-II**

**Industrial Chemistry**

**Paper – III, Unit operations-II (CHIC-103)      Periods:45**

**Heat Transfer:** **10P**

**1.1 Conduction:** Basic law of Conduction, Thermal conductivity, Compound resistances in series, Heat flow through a Cylinder.

**1.2. Convection:** Classification of Convection.

**1.3. Radiation:** Absorptivity, Reflectivity and Transmissivity, Krichhoff's law, Laws of black body radiation, Steafan-Boltsmann law, Heat Transfer by radiation.

**Unit-II**

**2.1. Heat Exchange Equipments:** **10P**

Single pass tubular condenser, Double pipe heat exchanger, Counter Current and Parallel flow, Energy Balances, Enthalpy balances in heat exchangers, Enthalpy balances in total condensers, Overall Heat Transfer Coefficients, LMTD, Individual Heat Transfer Coefficient, Calculation of Overall Coefficients from individual coefficients, fouling factors.

**UNIT-III**

**Industrial Aspects of Chemistry:** **10P**

**3.1. Glass:** Introduction, physical & Chemical Properties of Glass, Characteristics, Raw Materials, Chemical Reactions, Methods of Manufacture of Glass & Uses.

**Unit-IV**

**Pulp & Paper:** **07P**

**4.1 .** Introduction ,manufacture of pulp,chemical process,sulphate of pulp,sulphate pulp,Rag pulp Manufacture of Paper, Caladering, Uses of Paper

**4.2. Cement:** **08P**

Introduction, Composition, Types of Cement, Raw Materials, Manufacture of Cement by Wet & Dry Process, Reactions in the Kiln, Setting of Cement, Testing & Uses of Cement.

Reference Books:

1. Unit Operations of Chemical Engineering- McCabe Smith
2. Unit Operations-I (Fluid Flow & Mechanical Operations)- K. A. Gavhane
3. Unit Operations-II (Heat & Mass Transfer)- K. A. Gavhane
4. Heat Transfer- K. A. Gavhan
5. Principles of Heat Transfer & Mass Transfer- S. D. Dawande
6. Industrial Chemistry- B. K. Sharma.

## B. Sc. I Year Semester-I

### Paper – II, Process Calculations-I (Stoichiometry) (CHIC-102)

Periods: 45

#### UNIT-I

08P

**1.1 Units and Dimensions:** Introduction, Dimensions & Systems of Units, Fundamental Quantities, Derived Quantities, Conversions & Problems.

#### Unit-II

13P

**2.1 Basic Chemical Calculations:** Introduction, Mole, Atomic Mass & Molar Mass, Equivalent Mass, Solids, Liquids & Solutions, Important Physical, Properties of Solutions, Gases & Problems

#### UNIT-III

12P

**3.1 Material balances without chemical reactions:** Classification of Material Balance Problems, Material balances without chemical reactions, Outline of Procedure for Material Balance Calculations, Distillation, Evaporation, Absorption, Extraction, Drying, Filtration, Mixing, Crystallization and Problems on Material Balances.

#### Unit-IV

12P

**2.2 Material Balances with Chemical Reactions:** Stoichiometry, Stoichiometric Equations, Stoichiometric Coefficients, Stoichiometric ratio, Limiting reactant, Excess reactant, Conversion, Yield and Selectivity and Problems on Material Balances with Chemical Reactions.

**B. Sc. I Year Semester-II**  
**Paper – IV, Process Calculations-II (Stoichiometry) (CHIC-104)**

**Periods: 45**

**UNIT-I**

**20P**

**1.1 Energy balances:** Forms of Energy, Kinetic Energy, Potential Energy, Internal Energy, Heat, Work, General Energy Balance Procedure, Energy Balances on Closed Systems, Heat Capacity, Relation between  $C_p$  &  $C_v$  for an Ideal Gas, Empirical equation for Heat Capacities, Mean Molal Heat Capacities of Gases, Heat Capacities of gaseous mixture, Enthalpy Changes Accompanying Chemical Reactions, Heat of Reaction, Heat of Formation, Standard Heat of Formation, Heat of Combustion, Hess's law of Constant Heat Summation, standard Heat of reaction from heat of formation, Standard Heat of Reaction from Heats of Combustion, Effect of temperature on Heat of Reaction, Effect of Pressure on Heat of Reaction, Adiabatic Process, Adiabatic Reaction, Adiabatic Reaction Temperature, Phase Change Operation, Latent Heat of Vaporization, Latent Heat of Fusion, Latent Heat of Sublimation, Energy Balance during Phase Change Operation, Heat of solution and Heat of Mixing. (Numerical)

**Unit-II**

**10P**

**2.1 Recycle Operations:** Fuels. recycling-meaning & purpose Recycle Stream, Recycle Operation –block diagram, Purging Operation, Recycle reactor with purge, Combined feed ratio, Recycle ratio, Purge ratio, Examples

**UNIT-III**

**07P**

**3.1 Fuels:** Introduction, Calorific Value, Classification & Properties of Fuels.

**Solid Fuels:** Properties, Composition & Analysis of Coal.

**Gaseous Fuels:** Classification, Natural Gas, and LPG.

**Liquid Fuels:** Petroleum, Composition & Classification, Definition of Flash Point & Fire Point, Knocking, Octane Number, Aniline Point, Refining of Petroleum, Cracking, Thermal & Catalytic Cracking, Reforming, Thermal & Catalytic Reforming.

**Unit-IV**

**08P**

**4.1. Water Analysis:** Chemical & Physical Examination of Water, Chemical Substances affecting potability, Colour, Turbidity, Odour, Taste, Temperature, pH, Conductivity, Suspended Solids, Acidity, Alkalinity, Free Chlorine, Calcium & Magnesium, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand.

**Note:** 60 % Weightage will be given to Problems.

**Reference Books:**

1. Chemical Process Principles- Hougen & Watson.
2. Stoichiometry- B. I. Bhatt & S. M. Vora.
3. Introduction to Process Calculations (Stoichiometry)- K. A. Gavhane.
4. Industrial Chemistry By B. K. Shara.

**B. Sc. First Year Semester-I & II**  
**Paper-V, Laboratory Course (CHIC-105)**

**Periods: 120**

**List of Experiments to be taken:**

1. To Determine the Co-efficient of Venutrimeter.
2. To Determine the Co-efficient of Orifice meter.
3. To Study the Characteristics of Centrifugal Pump.
4. To Verify Hagen-Poisellue's Equation.
5. To Study the Pipe Fittings Test Rig.
6. To Study the Thermal Conductivity of Bad Conductor.
7. Determination of Acid Value of Lubricating oil.
8. Determination of Saponification Value of Lubricating oil.
9. Determination of Viscosity of Lubricant by Red Wood Viscometer.
10. Determination of Flash & Fire Point of Lubricating oil by
  - a) Cleveland's Apparatus (Open Cup)
  - b) Abel's Apparatus (Closed Cup)
  - c) Pensky-Marten's Apparatus (Closed Cup).
11. Determination of hardness of water.
12. Determination of percentage of iron in cement (Volumetrically).
13. Determination of amount of available chlorine in Bleaching powder.
14. Estimation of calcium in limestone.
15. Determination of dissolved oxygen (DO), chemical oxygen demand (COD) in given wastewater sample.
16. to measre the density of various liquids by pyknometer