Dr. Babasaheb Ambedkar Marathwada University Aurangabad.

Revised Syllabus

B.Sc. I Year (Semester I & II)

INDUSTRIAL CHEMISTRY

(Effective from June 2009 & onwards)

Industrial Chemistry Revised Syllabus w.e.f 2009-2010

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

Revised Syllabus of B.Sc. I Year Industrial Chemistry
(Effective from the Academic Year 2009-2010)
June 2009 & onward.

B.Sc. I Year Industrial Chemistry

(Three Year Degree Course)

Year	Paper	Course Name	Hours	Marks
B.Sc. I Year Semester–I	I	**Theory:** Fluid Mechanics & Unit Operations-I	45 (3 Credits)	100
	II	**Theory:** Material Balance & Process Calculations (Stoichiometry)	45 (3 Credits)	100
	III	Practical	45 (1.5 Credits)	100
	IV	Field work	45 (1.5 Credits)	100
B.Sc. I Year Semester–II	V	**Theory:** Aspects of Industrial Chemistry and Heat transfer	45 (3 Credits)	100
	VI	**Theory:** Energy Balances & Process Calculations	45 (3 Credits)	100
	VII	Practical	45 (1.5 Credits)	100
	VIII	Field work	45 (1.5 Credits)	100

B.Sc. I Year Industrial Chemistry

Semeseter I – Paper I

Paper – I: Fluid Mechanics & Unit Operations-I

45 hours **Marks : 100**

1. Flow of Fluids:

Definitions of fluids, Classification of fluids, Properties of fluids, Fluid Pressure, Pressure Head, Hydrostatic equilibrium for compressible and incompressible fluids. (08)

1.1 Appliction of fluid statics :

Mamometers, U-tube manometer, Inclined Manometer, Differntial Manometer, Continuous gravity decanter. (07)

1.2 Fluid Flow Phenomena:

Types of flow, Laminar flow, Shear Rate and Shear Stress, Turbulence-Reynolds Number & Transition from laminar to turbulent flow, Reynolds experiments Boundary layers, Flow in boundary layers, Laminar and Turbulent flow in bondary layers. (10)

2. Basic Equations of fluid flow:

Equation of Continuty, Bernoulli's equation, Pump work in Bernoulli's equation and its application. (05)

3. Transportation and Metering of fluids:

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. (15)

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

Semester I - Paper II

Paper – II Material Balance & Process Calculations (Stoichiometry)

45 hours **Marks : 100**

1. **Units and Dimensions**:
   Introductin, Dimensions & Systems of Units, Fundamental quantities, Derived Quantities, Conversions & Problems.
2. **Basic Chemical Calcuations**:
   Introduction, Mole Atomic Mass & Equivalent Mass, Solids, Liquids & Solutions, Important Physical Properties of Solutins, Gases and Problems
3. **Material Balances without chemical reactions** :
   Classification of Material Balance Problems, Material balances without chemical reactions, Outline Procedure for Material Balance calculations Distillation, Evaporation, Absorption, Extraction, Drying, Filtration, Mixing, Crystallization and problems on Material Balance.
4. **Material balences with Chemical Reactiions:**
   Stoichiometry, Stoichiometric eqquatins, Stoichiometric Coefficients, Stoichometric ratio, Limiting reactant , Excess reactant , Conversion, Yield and Selectivity and Problems on Material Balances with Chemical Reactions.

Semester – I Paper III
Practicals

Paper-III

45 hours **Marks : 100**

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. Determination of PH, Turbidity, Conductivity , Temperature, TDS, of given water sample by water Quality Analyzer Elico-PE-138
7. Determination of Hardness of water by Complex metric method using EDTA
8. Determination of Calcium & Magnesium Hardness Using EDTA
9. Determination of Dissolved Oxygen in a water sample
10. Determination of Chemical Oxygen Demand
11. Determination of BOD of a Waste Water Sample
12. Experiment of Proximate Analysis of Coal: Determine 1. Moisture 2. Volatile Matter 3. Ash 4. Fixed Carbon
13. Calculate Material Balance Rate of Evaporation for the given sample.
14. Perform Material Balance Calculation & Rate of drying of the given sample (Chalk / Sawdust)
15. To prepare various standard solution using ($^{W}/_{W}$, $^{W}/_{V}$, $^{V}/_{V}$) methods.

Reference Books:-

1. Practicals and Calculation in Engineering Chemistry – S.S. Dara,
2. Material Science – Soni

Semester – I Paper IV

Practical (Field work)

Paper – IV

45 hours **Marks : 100**

Industrial visit and preparation of the report on the aspects involved in the industry visited.

Industrial visit & submission of report	60 Marks
Viva	40 Marks

Semeseter II – Paper V

Paper – V: Aspects of Industrial Chemistry and Heat transfer

45 hours **Marks : 100**

1 Heat Transfer : (20 Hours)

1.1 Conduction :

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

1.2 Convection :

Classification of convection with mechanism

1.3 Radiation :

Abosrptivity, Reflectivity and Transmissivity, Krichhoff's law, Laws of black body radiation, Steafan-Boltsmann law, Heat Transfer by radiation.

2 Heat Exchange Equipments:

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

(25 Hours)

3 Fuels:

Introduction , Calorific Value, Classification & Properties of Fuels.

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

3.2 Gaseous Fuels : Classification, Natural Gas, LPG

3.3 Liquid Fuels : Petroleum, Composition & Classification, Definition of Flash Point & Fire Point, Knocking, Octane Number, aniline Point, Refining of Petroleum Cracking , Thermal & Catalytic Vracking, Reforming , thermal & Catalytic Reforming.

4 Water Analysis:

Chemical & Physical Examinatin of Water, Chemical substances affecting potability, colour, Turbidity, Odour, Taste, Temperature PH Conductivity , Suspended Solid, Acidity, Alkalinity, Free chlorine, Calcium & Magnesium , Dissolved Oxygen Biochemical Oxygen Demand , Chemical Oxygen Demand and Dissolved Solids.

5 Glass :

Introductin, Physical & Chemical Properties of Glass , Characteristics, raw Mateirals , Chemical Reactions, Methods of Manufacture of Glass & Uses.

6 Ceramics:

Intruduction , Classification and General Properties of Ceramics, Basic raw materials, Manufacturing Process, Manufacture of Porelain and China , Refractories, Classification, Properties, Manufacture of refractories, Manufacture of Fire Clay Bricks.

7 Cement:

Introduction, Composition , Types of cement, raw Materials, manufacture of Cement by wet & Dry process, Reaction in the Kiln, setting of cement, Testing & Uses of cement.

Reference Books:

1. Unit Operatin of Chemical Engineering – Mc Cabe Smith
2. Unit Operation –I (Fluid Flow & Mechanical Operations) – K.A.Ga vhane
3. Unit Operation –II (Heat & Mass Transfer)- K.A. Gavhane
4. Heat Transfer- K.A. Gavhane
5. Principles of Heat Transfer & Mass Transfer – S.D. Dawande
6. Industrial Chemistry – B.K. Sharma.
7. Heat Transfer – Domkundwar
8. Fluid Mechanics – Jagdish Lal
9. Process Control – Eckman
10. Environmental Chemistry – A.K. De

Semester II - Paper VI

Paper – VI Energy Balances & Process Calculations

45 hours **Marks : 100**

5. **Recycle Operations :**
   Recycle stream , purging operation, Recycle ratio, and Problems

6. **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 Cp & Cv 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 Reactions, 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 .

7. **Vapor Pressures**: Vaporization Boiling Point, Vapour Pressures of solids, Effect of Temperature on Vapor Pressure.

   Note: 60% weightage will be given to Problems.

Reference Books:

1. Chemical Process Principal – Hougen & Watson
2. Stoichiometry – B.I. Bhatt & S.M. Vora
3. Introduction to Process Calcutions (Stoichiometry)-K.A. Gavhane

Semester – II Paper VII

Practicals

Paper-VII

45 hours **Marks : 100**

List of Experiments:-

1. Determination of available Chlorine in Bleaching Powder
2. Estimation of Iron from Cement Volumetrically
3. Estimation of Calcium from lime stone
4. Determine Energy of Activation of the reaction between potassium persulphate and potassium Iodide
5. Preparation of CUS04 from Cu and its Material Balance
6. Calculate Material Balance rate of Evaporation for the given
7. Perform Material Balance calculations and rate of drying of the sample (Chalk/Sawdust)
8. To Study the Thermal Conductivity of Bad Conductor.
9. Determination of Acid Value of Lubricating Oil.
10. Determination of Saponification Value of Lubricating Oil.
11. Determination of Iodine Value of an Oil (Wij's Method)
12. Determination of Aniline Point of a Lubrication Oil.
13. Determination of Viscosity of Lubricant by Red Wood Viscometer.
14. 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).

Reference Book :

1. Water Analysis Hand Book - NEERI

Semester – II Paper VIII

Practical (Field work)

Paper – VIII

45 hours **Marks : 100**

Industrial visit and preparation of the report on the aspects involved in the industry visited.

Industrial visit & submission of report	60 Marks
Viva	40 Marks