FACULTY OF SCIENCE
Mohanlal Sukhadia University, Udaipur
M.Sc. Industrial Chemistry (CBCS) Programme

(Session 2016-17)

1. Duration of the course

The Master of Science Industrial Chemistry programme will be of four semesters duration under Choice based Credit system which will be conducted in two years. Each semester will be of approximately 5 months (minimum 90 working days in a semester) duration.

2. Eligibility:

Candidates seeking admission to the first semester of M.Sc.(CBCS) Industrial Chemistry must have a B.Sc. with Chemistry as one of the optional subjects or as a honours subject (10+2+3 scheme) with minimum 48% marks from a UGC recognized University.

3. Admissions:

Admissions to the first semester of M.Sc. (Industrial Chemistry) will be made as per admission rules for M.Sc. (CBCS).

4. Medium of instruction

The medium of instruction and examination shall be English.

5. Nature of course and no. of seats

M.Sc. (Industrial Chemistry) is a self financed course and no of seats as per information bulletin.

6. Curriculum

6.1 M.Sc.(Industrial Chemistry) programme has a two years, four semester prescribed course structure which in general terms is known as curriculum. It prescribes courses to be studied in each semester as given below.

6.2 M.Sc.(Industrial Chemistry) programme shall have a curriculum and course contents (syllabi) for the courses recommended by the committee courses in Industrial Chemistry and approved by the academic council of the University.

6.3 The programme shall follow Choice Based Credit System(CBCS) and will be governed by the Common Rules and Regulations of Masters programme under CBCS approved by the Academic Council of the University.

Courses of Study and Examination (2016-17)
List of courses

Core Courses: Theory

Course Code	Tittle of Course
M 1 IC 01-CT 01	Inorganic Chemistry
M 1 IC 02-CT 02	Organic Chemistry
M 1 IC 03-CT 03	Physical Chemistry
M 1 IC 04-CT 04	Spectroscopy in analysis-I
M 2 IC 01-CT 05	Environmental Green Chemistry
M 2 IC 02-CT 06	Instrumental techniques
M 2 IC 03-CT 07	Fundamentals of polymer chemistry
M 2 IC 04-CT 08	Spectroscopy in analysis-II
M 3 IC 01-CT 09	Specialty polymers
M 3 IC 02-CT 10	Industrial Aspect of Chemistry
M 4 IC 01-CT 11	Textile chemistry
M 4 IC 02-CT 12	Effluents treatment and waste management

Core Courses: Practicals

Course Code	Tittle of Course
M 1 IC 05-CP 01	Practical-A-I
M 1 IC 06-CP 02	Practical-B-I
M 2 IC 05-CP 03	Practical-A-II
M 2 IC 06-CP 04	Practical-B-II
M 3 IC 05-CP 05	Practical-A-III
M 4 IC 05 CP 06	Practical-A-IV

Discipline Specific Courses: Theory

Subject code	Tittle of course
M 3 IC 03 ET 01	Organic reagents, Natural products and Colorants
M 3 IC 04 ET 02	Principles of Chemical Engineering
M 3 IC 05 ET 03	Medicinal Chemistry-I
M 4 IC 03 ET 04	Agro based chemicals
M 4 IC 04 ET 05	Fuels, Petroleum and petrochemicals
M 4 IC 05 ET 06	Medicinal Chemistry-II

Discipline Specific Courses: Practicals

M 3 IC 06 EP 01	Practical-B-III
M 4 IC 06 EP 02	Practical-B-IV

Course codes are written in the following format

Masters programme (M)+Semester (1,2,34) + IC (Industrial Chemistry)+Serial Number of Course in the Semester(01,02,03 etc.) + hyphen("-") + Course type [Core Theory (CT), Core Practical (CP), Discipline Specific Theory (ET), Discipline Specific Practical (EP), Skill Practical (SP)].

For example; The Course code M1IC 01-CT01 should read as Master Programme First Semester Industrial Chemistry First Course-Core Theory Course-01

Note: -

1. Skill based courses will be offered on payment basis, which is Rupees 5000 per course with a minimum intake of 10 students in each course.

2. Candidate has to select any two papers from DSE in the III and IV semester.

3. Practical examinations will be conducted by the board of examiners consisting of one internal (to be appointed by the Course Director) and one external examiner (to be appointed by the University).

THE COURSES OF STUDY

M.Sc. INDUSTRIAL CHEMISTRY (2016-2017)

Semester I

S. No.	Course code	Title of the course	L-T-P	No. of credits	Max. marks 100		
					Uni. Exam	Int. exam	Total
1	M 1 IC 01-CT 01	Inorganic Chemistry	3-1-0	4	80	20	100
2	M 1 IC 02-CT 02	Organic Chemistry	3-1-0	4	80	20	100
3	M 1 IC 03-CT 03	Physical Chemistry	3-1-0	4	80	20	100
4	M 1 IC 04-CT 04	Spectroscopy in analysis-I	3-1-0	4	80	20	100
5	M 1 IC 05-CP 01	Practical-A-I	0-0-8	4	80	20	100
6	M 1 IC 06-CP 02	Practical-B-I	0-0-8	4	80	20	100
		Total		24	480	120	600

Semester II

S. No.	Course code	Title of the course	L-T-P	No. of credits	Max. marks 100		
					Uni. Exam	Int. exam	Total
1	M 2 IC 01-CT 05	Environmental Green Chemistry	3-1-0	4	80	20	100
2	M 2 IC 02-CT 06	Instrumental techniques	3-1-0	4	80	20	100
3	M 2 IC 03-CT 07	Fundamentals of polymer chemistry	3-1-0	4	80	20	100
4	M 2 IC 04-CT 08	Spectroscopy in analysis-II	3-1-0	4	80	20	100
5	M 2 IC 05-CP 03	Practical-A-II	0-0-8	4	80	20	100
6	M 2 IC 06-CP 04	Practical-B-II	0-0-8	4	80	20	100
7	M 2 IC 07-SE 01	Skill Course Elective	1-0-3	2	80	20	100
		Total		26	560	140	700

Semester III

S. No.	Course code	Title of the course	L-T-P	No. of credits	Max. marks 100		
					Uni. Exam	Int. exam	Total
1	M 3 IC 01-CT 09	Specialty polymers	3-1-0	4	80	20	100
2	M 3 IC 02-CT 10	Industrial Aspect of Chemistry	3-1-0	4	80	20	100
3-4	M 3 IC 03-ET 013	Organic reagents, Natural products and Colorants	3-1-0	4	80	20	100
	M 3 IC 03-ET 02	Principles of Chemical Engineering	3-1-0	4	80	20	100
	M 3 IC 03-ET 03 **(Select any two)**	Medicinal Chemistry-I					
5	M 3 IC 05-CP 05	Practical-A-III	0-0-8	4	80	20	100
6	M 3 IC 06 EP 01	Practical-B-III	0-0-8	4	80	20	100
		Total		24	480	120	600

Semester IV

S. No.	Course code	Title of the course	L-T-P	No. of credits	Max. marks 100		
					Uni. Exam	Int. exam	Total
1	M 4 IC 01 CT 11	Textile chemistry	3-1-0	4	80	20	100
2	M 4 IC 02 CT 12	Effluents treatment and waste management	3-1-0	4	80	20	100
3-4	M 4 IC 03-ET 04 M 4 IC 03-ET 05 M 4 IC 03-ET 06 **(Select any two)**	Agro based chemicals	3-1-0	4	80	20	100
		Fuels, Petroleum and petrochemicals	3-1-0	4	80	20	100
		Medicinal Chemistry-II					

5	M 4 IC 05 CP 06	Practical-A-IV	0-0-8	4	80	20	100
6	M 4 IC 06 EP 02	Practical-B-IV	0-0-8	4	80	20	100
7	M 4 IC 07-SE 02	Skill Course Elective	1-0-3	2	80	20	100
		Total		26	560	140	700

Credit table

Credits for all four semesters	100
No. of Core Course Credits	72
No. of Discipline Specific Course Credits	24
No. of Credits for SGPA and CGPA calculation	96
No. of Skill course credits	04

SEMESTER-I
M 1 IC 01-CT 01
Inorganic Chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Corrosion: Introduction to corrosion problem, principle of corrosion, types, mechanism of electrochemical corrosion, factors influencing corrosion, thermodynamic considerations and electrode kinetics, special types of corrosion-soil, pit, atmospheric, stray and current corrosion.

Corrosion testing methods: Prevention methods based on changing properties of materials, change in environment and minimizing or stopping the corrosion current.

Unit-II

Lubricants: Introduction, Classification and Functions of lubricants, Mechanism of lubrication, Types of lubricants-solid, semi-solid, liquid and synthetic lubricants, Lubricating oil properties.

Unit-III

Extraction of Metal: Major and minor constituents of ores, methods of sampling and dissolution of ores, analysis of copper, lead, zinc, silver, iron, manganese and tungsten.

Unit-IV

Homogeneous catalysis: Study of some important homogeneous reactions catalyzed by transition metal and their complexes.

(i) Catalytic addition of molecules to C-C multiple bonds, hydrogenation of unsaturated compounds.
(ii) Carbonylation Reactions – Methanol to acetic acid, methyl acetate to acetic anhydride, adipic ester synthesis.
(iii) Oxidation reaction- Oxidative carbonylation, palladium catalysed oxidation of ethane, acrylonitrile synthesis, oxalic acid synthesis,
(iv) Polymerisation, oligomerisation and metathesis reaction of alkenes, alkynes, Ziegler-Natta polymerization of ethylene and propylene.

Unit-V

Heterogeneous catalysis: Study of some important heterogeneous reactions catalyzed by transition metals and their compounds.

(i) Reduction of carbon monooxide
(ii) Hydrogenation of nitro compounds
(iii) Synthesis of ammonia

SEMESTER-I
M 1 IC 02-CT 02

Organic Chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Reaction mechanism: σ and π bond, kinetic and thermodynamic control of reaction, transition state and intermediates, methods of determining reaction mechanism, isotope effect, effect of reactivity, linear free energy relationship (Taft and hammett equation).

Unit-II

Introduction of following types mechanism: Type of reaction – Addition (nucleophilic, electrophilic, free radical), Substitution (nucleophilic, electrophilic, free radical), Elimmination and rearrangement reaction.

Unit-III

Name reactions: Hoffmann-loffler-fretag reaction, Chichibabin reaction, Sharpless asymmetric reaction, Barton reaction, Aldol, Perkin, Stobbe, Dieckman condensation, Michael addition, Mannich reaction.

Unit-IV

Disconnection approach: Elementary idea of disconnection, an introduction to synthesis, synthetic equivalents, functional group one and two group (C-X and C-C disconnection), Interconversions, chemoselectivity, Diels-alder reaction, 1,3 and 1,5 difunctionalised compounds, α,β unsaturated carbonyl compounds, Michal reaction, robinson annelation.

Unit-V

Pericyclic reaction: Selection rules and stereochemistry of electroyclic reaction, cycloaddition and sigmatropic shifts, Sommlet-hauser, cope and clasien rearrangements, structural elucidation of organic compounds.

SEMESTER-I
M 1 IC 03-CT 03

Physical Chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits : 4

Unit-I

Chemical kinetics: Different methods to determine rate of reaction, factors affecting rate, half life time, order of reaction, entropy and activation energy of reaction and determination, idea of chain conservation, parallel and opposite reactions, oscillation reaction, kinetic salt effect and solvent effect on rate.

Unit-II

Thermodynamics: thermodynamic systems, laws of thermodynamics and their applications, concept of work, entropy, internal energy, free energy, spontaneous energy, heat engine efficiency , gibb's-helmholtz equation, clausius-clapeyron equation and their uses, chemical potential and uses, heat capacity – Cp and Cv.

Unit-III

Electrochemistry: Standard electrode potential, EMF measurement, different types of electrodes, electrolysis, conductometric and potentiometric titration, pH concept, polarization, overvoltage, decomposition potential storage cells, fuel cells, electrochemical cells and notations.

Unit-IV

Thermochemistry: Thermochemical reactions, laws of thermochemistry, Kirchhoff's equation, standard heat of formation, combustion, heat of reaction and their related mathematical problems.

Unit-V

Surface chemistry: Chemical and physical adsorption, adsorption isotherms, Frendlich-langmuer adsorption isotherms, reactions on solid surface, industrial uses of adsorption.

SEMESTER-I
M 1 IC 04-CT 04
Spectroscopy in Analysis-I

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Ultraviolet and visible spectroscopy: Electronic transition , instrumentation, shift of bands with solvents, the isolated double bond , conjugated dienes , effects of geometrical isomerism (steric effects, effects of alkyl substitution and ring residue), exocyclic double bonds, woodward-feiser rule, effect of strain around the diene, chromophore, polyenes, UV spectra of carbonyl compounds, unsaturated aldehyde and ketones, UV spectroscopy

Unit-II

Atomic absorption spectroscopy: Principle, instrumentation and application.

Unit-III

Flame Photometry: Principle, instrumentation and application

Photoelectron spectroscopy: Frank-codon principle, type of electron spectroscopy, ESCA-theory, instrumentation and application, Auger emission spectroscopy- theory , instrumentation and applications.

Unit-IV

IR spectroscopy: Molecular vibrations, calculation of vibrational frequencies, instrumentation, finger print region, IR of alkanes and effect of some functional groups, effects of hydrogen bonding, Fermi resonance, overtones, shifting of bands due to inductive and mesomeric effects, aromatic and heteroaromatic compounds, effects of ring strain , application of IR spectroscopy, brief idea of FT-IR.

Unit-V

Raman spectroscopy: Theory, stokes and anti stokes line, Raman depolarization ratio, instrumentation, intensity of Raman peaks, applications.

Microwave spectroscopy: Theory, selection rules, diatomic molecules as non-rigid rotator, symmetric top molecules, P-Q-R bands, instrumentation, limitations and applications.

SEMESTER-I

M 1 IC 05-CP 01

(Practical-A-I**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

Organic synthesis (Yield, Crystallization, M.P. determination, IR characterization)

1. Preparation of m-dinitrobenzene from nitrobenzene
2. Preparation of m-nitroaniline from m-dinitrobrnzene
3. Preparation of methyl orange
4. Synthesis p-nitro acetanilide from acetanilide
5. Preparationof 2-iodobenzoic acid from anthranilic acid
6. Thiamine catalyzed Benzoin condensation
7. Synthesis of 2,4 diacetyl-pentanedioc acid diethyl ester
8. Synthesis of 3-methylpyrazol-5-one
9. Synthesis of Benzylidene acetophenone
10. Synthesis of p-bromoacetanilide
11. Synthesis of Urotropine (hexamethylenetetraamine)
12. Synthesis of picric acid
13. Synthesis of oil of winter green

Organic estimations

1. Glucose estimation
2. Phenol estimation
3. Aniline estimation

SEMESTER-I
M 1 IC 06-CP 02
(Practical-B-I**)**

Credits 4; Time 8h **M.M. 100**
80 marks (External)
20 marks (Internal)

Analysis of Minerals/Ores/Alloys

1. Determination of CaO & MgO, Al_2O_3 and Silica in supplied mixture - 2
2. Analysis of Brass (Cu & Zn contents)/ Solder(Sn & Pb contents) - 2
3. Analysis of Wood's Metals Bi/Cd/Pb – 2

Water analysis

1. Total hardness of water
2. Alkalinity-OH^- /CO_3^{2-}/OH^-+HCO_3^-
3. Chloride contents

Physical Experiments

1. Study of first order kinetics
2. Study of second order kinetics
3. Determination of Viscosity

SEMESTER-II
M 2 IC 01-CT 05

Environmental Green Chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits : 4

Unit-I

Principle and concept of Green Chemistry: Introduction, definition, principles, atom economy, atom economic and atom uneconomic reaction, reducing toxicity.
Waste: Production, Problems and Preventions: Introduction, Problem caused by waste, source of waste, cost of waste, waste minimization techniques, on-site waste treatment, design for degradation, polymer recycling.

Unit-II

Green Solvents: Organic solvents, solvent-free systems, controlling of solvent-free reaction, supercritical fluids (H_2O and CO_2), fluorous biphase solvents.
Green reagents: Introduction, methods of designing safer chemicals, avoidance of toxic functional groups, examples of greener reagents including replacement of phosgene, methylations using dimethyl carbonates and other polymer supported reagents, solid state polymerization, alternative nitrile synthesis. Introduction of catalysis, Biocatalysis and phase transfer catalysis.

Unit-III

Green Synthesis: Design for energy efficiency, classification and application of green synthesis including Microwave Assisted Synthesis, green synthesis of polycarbonates, paracetamol, ibuprofen, citral, urethane, adipic acid, styrene, α, β-unsaturated nitroalkenes.

Unit-IV

Environmental Chemistry: Atmosphere chemical and photochemical reaction in the atmosphere, oxygen and ozone chemistry, green house gases and effect, hydrosphere- physical chemistry of sea water, eutro-phication, sewage treatment, lithosphere and chemistry involved, smoke formation acid rains. A brief idea of toxicological effects of arsenic, lead, cadmium, mercury, ozone,PAN, cyanide, pesticides. Oxide of nitrogen, sulphur and carbon, carcinogens.

Unit-V

Analysis of pollution: Sampling and monitoring of air and water, determination of total dissolved solids, conductivity, acidity, alkalinity, hardness, chloride, slphate, fluoride, phosphate and different forms of nitrogen, phenols, pesticides, surfactants DO, BOD and COD microorganism. Catalysis of aquatic chemical reactions, water pollution lows and standards.

SEMESTER-II
M 2 IC 02-CT 06

Instrumental Techniques

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

UNIT-I

Thermo Gravimetry Analysis(TGA) and Derivative. Hermogravimetry(DTG): Principle, instrumentation and application, factor affecting TG curves,

Differential Thermal Analysis(DTA): Principle, instrumentation and application, factor affecting TA curves

Differential Scanning Calorimeter(DSC): Principle, instrumentation and application, factor affecting DC curves, comparison with DTA.

UNIT-II

D.C.Polarography: Basic principle, types of currents, experimental technique, Illovic equation (no derivation) and application of polarography

Principle, technique and application of;

(i) Voltametric and cyclic voltametery
(ii) Amperometry
(iii) Anodic stripping voltametery

UNIT-III

High Performance Liquid Chromatography(HPLC): Introductory knowledge of adsorption basic principle, instrumentation and applications of HPLC, comparison with gas liquid chromatography.

Gas Liquid Chromatography: Principle, instrumentation and applications.

Gel Permeation or Size Exclusion Chromatography: Introduction, theory and application

UNIT-IV

Ion Exchange: Introduction, types-cationic, anionic, chelating and liquid ion exchangers, preparation, action and properties of exchangers and applications of ion exchangers

Solvent Extraction, ion association complexes

Gel Electrophoresis: Introduction, Factors affecting ionic migration, detection of separated components and applications of Gel electrophoresis.

UNIT-V

Radioactive Technique: Tracer technique, neutron activation analysis, counting technique such Geiger-Muller, ionization and proportional counters

Light Scattering Techniques: Principle, instrumentation and applications of nephelometery and Raman spectroscopy.

Books recommended:

1. Ion exchange separations in Analytical Chemistry. O.Samuelson, John Wiley
2. Exchangers amd Solvent Extractions, J.A.Marinsky and Y.Parcus, Marcel Dekker
3. Polagraphic Techniques, I.Metes, Interscience
4. Gel Chromatography, Tibor Kremmer and Laszol Boross, Wiley

SEMESTER-II
M 2 IC 03-CT 07
Fundamental of polymer chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits : 4

Unit – I

Introduction of Polymer: Definition of Polymer, Classification of Polymer, Bonding in Polymer, History of Polymer.
Raw Materials: Oil, Natural gas, Coal, Types, Grades and indication of manufacturing, Source of natural Polymers and derivatives

Unit – II

Addition Polymerization: Cationic, Anionic, and Free-radical.
Kinetics of Polymerization – Free radical, cationic, anionic.

Unit – III

Coordination Polymerization: Ziegler Natta Catalysts and Stereo regular polymers **Condensation Polymerization**: Types, extent and degree of Polymerization and kinetics. Carother's equation, ring opening Polymerization.

Unit – IV

Copolymerization: Mechanism, reactivity ratio and composition – Block and graft copolymers. Kinetics of copolymerization.

Unit – V

Polymerization techniques: Bulk, Solution, Suspension, Emulsion, Melt Polycondensation, Solution Polycondensation, Interfacial condensation, solid and gas phase polymerization. Their advantages and disadvantages with application.

Recommended Books:

1. Polymer science: V.R. Goowarikar,N.V. Viswanathan,Jayadev Sridhar

2. Text book of polymer science: Fred W. Billmeyer

3. Polymer science & Technology: Joel R. Fried

4. Polymer Science and Technology: Premamoy Ghosh

SEMESTER-II
M 2 IC 04-CT 08

Spectroscopy in analysis-II

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Mass Spectrometry: Introduction, ion production-EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds common functional groups, molecular ion peak, meta stable peak, McLafferty rearrangement, Retro Diels-Alder reaction, nitrogen rule, high resolution mass spectrometery. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Unit-II

Nuclear magnetic resonance spectroscopy: General introduction and definition, chemical shift, spin-spin interaction, Shielding mechanism, mechanism of measurement, chemical shift values and correlation for proton bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercaptols), chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), virtual coupling stereochemistry, hindered rotation.

Karplus curve variation of coupling constant with dihedral angle. Simplification of complex spectra-nuclear magnetic double resonance, contact- shift reagents, solvent effects. Fourier transform techniques, nuclear overhouser effect (NOE). Resonance of other nuclei-^{19}F,^{31}P.

Carbon-13 NMR Spectroscopy: General consideration, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon) coupling constants. Two dimension NMR spectroscopy, COSY, NOESY, DEPT, INEPT, APT and INADEQUATE techniques.

Unit-III

Electron spin resonance spectroscopy: Hyperfine coupling, spin polarization for atoms and transition metal ions , spin-orbit coupling and significance of g-tensors, applications of transition metal complexes (having one unpaired electron) including biological systems and to inorganic free redicals such as PH_4, F_2, and $[BH_3]$.

Unit-IV

X-ray Diffraction: Bragg-condition, Miller indices, Laue method, Bragg method, Debye-Scherrer method of x-ray structural analysis crystals, Index-reflaction, Identification of unit cells from systematic absence in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem, description of the procedure for an x-ray structure analysis, absolute configuration of molecules, Ramchandra diagram**.**

Electron diffraction: Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structures of surfaces.

Neutron diffraction : Scattering of neutron by solid and liquid , magnetic scattering, measurement techniques, elucidation of structure of magnetically ordered unit cell.

Unit-V

Mossbauer spectroscopy : Basic principles, spectral parameters and spectral display, application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds, nature of M-L bond, coordination number, structure (3) detection of oxidation state and inequivalent MB atoms.

SEMESTER-II

M 2 IC 05-CP 03

(Practical-A-II**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

Organic synthesis (two stage preparation) including Crystallization, Percent Yield and M.P. and FTIR spectral studies

1. Synthesis of azo dyes
2. Synthesis of Eosin from Pthalic Anhydride
3. Preparation of benzanilide using Beckmann rearrangement
   Some preparation to be added

Chromatography

1. Separation and identification of amino acids by TLC
2. Separation and identification of organic compounds by TLC
3. Extraction and Identification of artificial food colours

SEMESTER-II

M 2 IC 06-CP 04

(Practical-B-II**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

Coal Analysis :

1. Moisture contents
2. Volatile matter
3. Ash contents
4. Fixed carbon

Oil Analysis

1. Determination of acid value of vegetable oils mineral oil/ lubricating oil
2. Determination of saponification value of vegetable oils
3. Determination of Iodine value of vegetable oils
4. Flash point determination of mineral oil/ lubricating oil
5. Aniline point determination of mineral oil/ lubricating oil
6. Determination of viscosity of mineral oil/ lubricating oil

Conductometric and spectrophotometric analysis

1. Acid strength by conductometric titration
2. Spectrophotometric analysis of Rock phosphate
3. Spectrophotometric estimation of Iron in synthetic sample
4. Spectrophotometric estimation of Chromium in synthetic sample

SEMESTER-III

M 3 IC 01-CT 09
Speciality Polymer

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit – I

High temperature and fire resistant polymer: Introduction, Polymers for high temperature resistance, Fluropolymer, Aromatic polymers, Hydrocarbon polymers, Polyethers, Polyphenyl sulphide, Polysulphones, Polyesters, Polyamides, Polyketones, Heterocyclic polmers.

Hydrophilic Polymers: Introduction, Natural polymers – Carbohydrate, Proteins, Semi-synthetic polymers, Hydrogel, Polyacrylamides hydrophilic polymers, Polyvinyl alcohol, Polyvinyl pyrrolidone.

Unit – II

Polymers with electrical and electrometric properties: Introduction, Conductive polymers, Photo conducting Polymer, Polymers with piezoelectric, Piezoelectric and ferroelectrics properties, and Photo resists for semiconductor fabrication.

Conducting Polymer: Definition, Inherently conducting polymer: polyacetylene, polydiacetylene, polyaniline, poly (p-phenylene sulphide), photo conducting polymers

Unit – III

Ionic Polymers: Introduction, Classification, Synthesis physical properties and application, Ionomers based on polyethylene, Polystyrene, Ionomers with Polyaromatic backbones, Polyelectrolyte, Polyelectrolyte complexes

Biopolymers: Introduction, Definition, classification, advantages and disadvantages, Applications of Biopolymers in : 1) Drug delivery system, 2) Disposable in Health Care, 3) Packaging, 4) Medication

Structure and properties of natural polymer: - polypeptides Proteins nucleic acid, based, poly lactic acid, PHBV, Carbohydrates.

Unit –I V

Inorganic and Organic Polymer: Introduction, Inorganic reaction mechanism, Condensation organ metallic, polymers, Addition polymers, coordination polymers, Sol Gel, Portland cement, Silicates, Silicon dioxide, Asbestos, Diamond, Graphical, Polysulphur

Unit-V

Outline manufacturing and properties of

Polyethylene	Polyimides
Polypropylene	Polyacrylanitriles
Polystyrene	Polyvinyl alcohol
Polymethylmethacrylate	Polyvinyl acetate
Polyvinyl chloride	Phenol formaldehyde resin
Polyurethanes	Urea formaldehyde resin
Polyesters	Melamine formaldehyde
Polycarbonates	Melamine formaldehyde resin
Polyamides	Epoxy resins.

Recommended Books:

1. Polymer science: V.R. Goowarikar,N.V. Viswanathan,Jayadev Sridhar

2. Text book of polymer science: Fred W. Billmeyer

3. Polymer science & Technology: Joel R. Fried

4. Polymer Science and Technology: Premamoy Ghosh

5. Specialty polymers: R.W. Dyson

SEMESTER-III
M 3 IC 02-CT 10

Industrial aspects of chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Fertilizers: Introduction, types and synthesis of nitrogenous, ammonia based, phosphoric acid and phosphatic fertilizers.

Unit-II

Glass and Ceramics: Glass manufacture and different types of glasses, manufacture of fused, silica, safety and poetical glass, glass fibers, manufacture of ceramics and refractories, super refractories, insulating and pure oxide refractories, modern ceramics.

Unit-III

Cement Industry: Types of cement manufacture of Portland cement, composition, setting and hardening of cement, mortars and concrete, gypsum, plaster of paris, estimation of silica, alumina, calcium oxide and sulphates in Portland cement.

Unit-IV

Silicates and mineral resources: Feldspar, Asbestos, Mica talc, pyrophylite and steatite, Zeolites, ultramarines.

Unit-V

Explosives: Classification, Characteristic, preparation of nitrocellulose-TNT, Picric acids, Dynamite-cordrate and Gunpowder, dynamites, HMX, PETN, Cyclonite, plastic explosives, gelatin, RDX, Cordite and sesmic explosives, properpellants-manufacturing of liquid and solid properpellants-hydrazine, incendiaries and smoke screens and their industrial applications.

SEMESTER-III
M 3 IC 03-ET 01

Organic Reagents, Natural Products and colorants

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Reagents in organic synthesis: Use of the following reagents in organic synthesis and functional groups transformation, Gilman's reagents, lithium dimethyl cuprate, LDA, Dichlorohexylcarbodiimide, trimethyl silyl iodide, Tributyltinhydride, DDQ, Baker yeast, Petersons synthesis, Merrifield resins, 1,3 dithiane, selenium oxide, Osmium tetraoxide. Reagents containing phosphorous, silicon and borons and organic synthesis: preparation, properties, applications and mechanistic details.

Unit-II

Dyes: Introduction, classification, color and chemical constitution of dyes. Chemistry of Azodyes, anthraquinone dyes, Indigoid and disperse dyes.

Unit-III

Paints: History, components:binder, vehicle, solvent, additives; colour changing paint, applications, product variants.

Pigments: History, manufacturing and industrial standards, scientific and technical issues, swatches, biological pigments, pigments and chemical composition.

Unit-IV

Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants, structure, stereochemistry, synthesis and biosynthesis of following – Ephedrine, (+) – Coniine, Nicotine, Atropine, Quinine and Morphine.

Porphyrins: Structure and synthesis of haemoglobin and chlorophyll.

Unit-V

Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progestrone, Aldosterone, biosynthesis of steroids.

SEMESTER-III
M 3 IC 04-ET 02

Principals of Chemical Engineering

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Concept of unit operation and unit process: Application of thermodynamics in unit process, combustion reaction, theoretical air, excess air, air fuel ratio, analysis of products of combustion, internal energy and enthalpy of reaction, heating value of fuels, enthalpy of formation, adiabatic flame temperature, entropy changes for reactive mixtures.

Unit-II

Chemical process kinetics: Types of chemical reactions, catalytic rate equations, adsorption-equations, factors affecting a chemical process, reactor shape and effect of back mixing on products distribution, selection and sizing of homogeneous and catalytic reactor.

Unit-III

Heat Transfer: The nature of heat flow, steady flow of heat in homogeneous body, series resistance to flow of heat, concept of the film, overall coefficients, magnitude of heat transfer coefficients and fouling factors, heat exchange concepts in scale up, heat exchangers.

Unit-IV

Mass Transfer: Different modes of mass transfer, concentration, various velocities and fluxes, Fick's law of diffusion.

Unit-V

Separation Process: Characteristics of separation process phase equilibrium separation-on, two and three components, separation factors, selection of a separation process.

SEMESTER-III
M 3 IC 05-ET 03

Medicinal Chemistry-I

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Drug Design: Rational approach to drug design, methods of variation, tailoring of drugs.

Physical and Chemical factors: factors governing the biological activities of drugs, physical properties, dissociation constants, chemical properties, isosterism and bio-isosterism.

Unit-II

Antipyretics and Analgesics : Salol, Cinchophen, Aminopyrine, Livorphanol, Peethidine.

Antivirals: Methisazone, Idozuridine.

Unit-III

Hypnotics and Sedatives: Barbiturates, Phenobarvitone, Nitrazepam, Gluethimide and their mode of action.

CNS stimulants: Caffeine, Ethamivan, Phentermine, and their mode of action.

Unit-IV

Cardiovascular agents: Introduction, Classification, Cardic glycosides, antihypertensive and hypotensive drugs, antiarrythanic agents, Vasopressor drugs, resin angiotensin pathway.

Antihistaminics: Classification, structure activity relationship and synthesis of promethazine, Phenindamine, Chlorophenamine.

Unit-V

Antimalarials: Classification, quinine, 4-amino-quinoline and 8-aminoquinoline analogues, guanidines, biguanides, pyrimidine drugs, miscellaneous drugs.

Antibiotics: Introduction, Classification, β-lactam antibiotics, penicillines, cephalosporins, chloramphenicol, tetracyclines.

SEMESTER-III
M 3 IC 05-CP 05

(Practical-A-III**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

Polymer Synthesis

1 Preparation of Urea formaldehyde resins
2 Preparation of Phenol formaldehyde resins
3 Preparation of Thiol rubber
4 Preparation of Condensation polymer
5 Preparation of Epoxy resin
6 Preparation of Polymerisation of acrylonitrile
7 Preparation of Solution polymerization of vinyl acetate
8 Prepration of free radical polymer

Characterization of polymers

1 Determination of MP, strong time and gel time of phenolic resins.
2 Determination of molecular weight by amine and group analysis.
3 Determination of viscosity of polymer by Ubelod viscometer and hen's M.W.
4 Determination of Ash content.
5 Determination of specific gravity of prepared polymer/resin.
6 Determination of acid value of plastic material.
7 Determination of saponication value of plastic material.
8 Determination of iodine value of plastic material.
9 Determination of hydroxyl value of plastic material.
10 Determination of carbonyl value of plastic material.
11 Determination of molecular weight of polymer.
12 Determination of capacity of a cation exchange value of polymer.
13 Determination of capacity of an anion exchange value of polymer.

SEMESTER-III

M 3 IC 06-EP 01

(Practical-B-III**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
21 marks (Internal)

Chromatography

1 Separation of components of tablet using preparative TLC and identification by FTIR and UV-VIS spectroscopy.

Extraction

1 Extraction of caffeine from Vivarin.
2 Extraction of Nicotine from tea leaves
3 Extraction of casein from milk
4 Extraction of piperidine from pepper.

Titrimetric estimation of drugs

1 Estimation of paracetamol
2 Estimation of Ascorbic acid
3 Estimation of Aspirin
4 Estimation of Sulpha Drugs
5 Estimation of Benzocaine

SEMESTER-IV
M 4 IC 01 CT 11

Textile Chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Historical development of natural and synthetic dyes, dyestuff industries in India, classification of dyes according to chemical constitution, method of preparation of nitroso, nitro, azo dyes, pyrazolone, acridine, ketoamine, anthraquinones, azines, thiazines, oxazine, Indigo, thio indigo alizarine and various dyes.

Unit-II

Chemical bond their role and involvement in dyeing of different textile materials, role of chemical bonds in colour fastness of dyes, physical and chemical principals involved in the application of dyestuff e.g. direct, basic, acid, vat, disperse, azioc, pigments dyes etc.

Unit-III

Evalution of textile chemicals axilary's VIZ detergents, wetting agents, cross linking agents, softners, stiffeners, silicone emulsions. Study of various method of dyeing, various form of dyes and their application.

Unit-IV

Isolation of products for manufacturing of dye intermediates, dyes intermediate related to hydroxy, helogencompounds and heterocyclic compopunds general method of nitration of toluene phenol, aniline, naphthalene series. Chemistry of benzene and naphthalene with their orientation. General method of dye sulphonation of benzene and aniline, napthalenes, napthols, sulphonic acid, General method of amination of nitro compounds and naphthalene series.

Unit-V

Relation between colour and chemicals constitution, substantively and chemical constitution, chemistry of various types of pigments fluorescent brightening agents and miscellaneous dyes. Toxicity of dyes and dyes intermediates.

Books recommended:
1. Technology of dyeing , V.A. Shehnai vol-6
2. Textile chemistry, R.H. Peter, Vol-3
3. Evalution of textile chemicals, V.A. Shhnai vol-8
4. Theory of coloration of textiles C.L Bird

SEMESTER-IV
M 4 IC 02 CT 12

Effluents treatment and waste management

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Industrial Pollution; Introduction, principal causes of industrial pollution, environmental problems of caustic-chlorine industry, thermal power plants, nuclear power reactors, fertilizers and chemical industries, tanner industries, agro based industries, pulp and paper industry, distillery industry, plastic industry, detergent industry, sponge iron industry.

Unit-II

Industrial waste and treatment processes: Introduction, types of industrial wastes, principal of industrial waste treatment, protection of biosphere and surface water from industrial waste, treatment and disposal industrial waste, treatment of waste or effluents with organic impurities and inorganic impurities, effluents of industrial unit and their purification, treatment of some industrial pollutants.

Unit-III

Environmental toxicology: Introduction, Route and mechanism of toxicant entry to organism, Distribution of toxicants with within the toxicants, biotransformation of toxicants, excretion of toxicants, classes of poisons based on effect, quantitative principals of toxicology, Experimental testing for toxicity.

Unit-IV

Radioactive pollution: Source of radioactive pollution, natural and anthropological radioactive pollution, classification and effect of radiation, harmful effects of various radiations, protection and control from radiation, types of radioactive waste, disposal method of radioactive waste, radioactive waste detector.

Unit-V

Waste management ; Introduction, Municipal waste and environment, Land filling , Incineration, dioxins, disposal of medical waste, emmunisation waste, electronic waste, paper waste and their recycling, Reed bed system.
Management of hazardous chemicals: Introduction, brief idea of sampling and monitoring, techniques for chemical analysis, quality assurance and quality control.

Books recommended:
1. Environmental chemistry, B.K. Sharma, Goel publishing house
2. Basic concept of environmental chemistry, D.W. Connell, CRC, Taylor & francis

SEMESTER-IV
M 4 IC 03 ET 16

Agro based Chemicals

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Paper and Pulp Industries: Manufacture of pulp, mechanical and chemical pulping, manufacturing of paper.

Oil/fats/Wax/Soaps: Fatty acids and triglycerides, Saturated and unsaturated fats, hydrogenation, polymerization, rancidity of oils, fat analysis, Butter, margarine and mayonnaise, Waxes: Their types and applications, Soap and soap manufacture, Hard and soft soaps, Disadvantages of soaps over synthetic detergents.

Unit-II

Fermentation industry: Anaerobic and aerobic fermentation production of antibiotics acids (lysine,glutamic acid), alcohol, acetone, butanol, lactic acid, citric acid, vitamins and enzymes, brewing industry.

Perfumes: Introduction of perfumes and perfumery chemicals, theory of olfaction and mechanism, classification of perfumes, Essential oils and their isolation, Some important terpenes and esters, Flavors, synthesis of civetone and Muskone, relation between perfumes and pheromones.

Unit-III

Surfactants: Classification with example, adsorption micelle formation, manufacture of anionic, cationic, zwitterionic and nonionic detergents, applications in industries. Application as foaming agent, wetting agents, Dispersant, solublizers, emulsifiers and rheology modifiers, detergents formulations, detergents, biodegradation, biosurfactants**.**

Unit-IV

Pesticides: Introduction, classification, synthesis of few common pesticides of chlorinated (DDT, BHC, chlordane, aldrin), organophosphorus and carbamate (parathion, malathion, carbaryl) compounds family, Plant Pesticides, pesticide formulations.

Unit-V

Food and dairy chemistry: Composition and chemistry of cream, butter, ghee, ice-cream, cheese, condensed and dried milk, infant food, spoilage of ghee and use of antioxidant, chemistry

of milk fermentation, chemistry of rennin coagulation of milk and changes occurring during ripening of cheese, physicochemical changes in manufacture and storage of milk powder lactose, crystallization and its significance, physicochemical changes during the manufacture of indigenous milk product, quality standard of dairy product.

SEMESTER-IV
M 4 IC 04 ET 17

Fuels, Petroleum and petrochemicals

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Introduction of fuel, Calorific value, determination of CV, Modern concept of fuels. Classification of fuels, criteria of selection of fuel, methods of processing of various fuels.

Unit-II

Coal & coal chemicals: Origin of coal, types of coal and their purification, recovery of coal chemicals, process of combination products, fractional distillation of coal tar, uses of tar & tar products.

Unit-III

Petroleum: Origin, distribution, process of production, composition, classification and distillation of crude petroleum.

Unit-IV

Processing of liquid fuels such as petroleum and petroleum products.

Unit-V

Manufacture of following compounds: Methane, ethylene, acetylene. Preparation of the following from methane, methanol. Hydrogen cynaide, carbondisulphide. Preparation of following from ethylene, Ethyl chloride, ethanol, ethylene oxide, ethylene glycol ,acetic acid, styrene, vinyl acetate, benzene, Xylene, acrylonitrile, butandionols etc. Various crystals used in petrochemical industry, preparation, applications and selectivity.

SEMESTER-IV
M 4 IC 05 ET 18

Medicinal Chemistry-II

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Drugs: Structurally specific and non-specific drugs, Thermodynamic activity, Various theories, Meyer overtone and Hemmi theory, Fergusen theory, Cutt of point , steric factor, Verloop steric parameter, Carig plot and Topliss scheme, ADME concept, Molecular modeling and drug design.

Unit-II

General Anesthetics: Classification , Various theories for mode of action of general anesthetics.

Local Anesthetics: Chemical classification, lofgrens classification.

Anti-inflammatory drug: NSAIDS, classification, Structure, Synthesis and mode of action of Ibuprofen, Diclofanac sodium, Indemethacin, Naproxen, Pyroxicam.

Unit-III

Anticonvulsants: Troxidone, Phensuximide , Phenytoin and their mode of action.

Antianxiety drug and Tranquilizers: Diazepam, Metaxalone tybamate chlorpromazine hydrochloride and their mode of action.

Unit-IV

Diuretics: Mericurial and non-mericurial diuratics, Merallurice mercaptomerin chlorothiazide and their mode of action.

Antiparkinsonian agents: Classification, Biperiden, Procyclidine, Benztropine mesylate, Levodopa and their mode of action.

Unit-V

Antineoplastic agents: Chemotherapeutic intervanation, Classification, Alkylating agents, methane sulphonates, Ethylenimines, Nitrosaureas, Azothiopurines, Cylarabine, Flurouracil, Vinblastin.

Antithyroid drugs: Classification and mode of actions.

Prostaglandins and their bio-activity.

SEMESTER-IV
M 4 IC 05 CP 06

(Practical-A-IV**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

1 Volumetric analysis of ternary mixture of inorganic salts, like Bi^{+3} Pb^{+2} Cd^{+2} etc.
2 Study of specific rotation of drug molecules
3 Estimation of metals (Pb^{+2}, Cd^{+2}, Cu^{+2}, Hg^{+2} , As^{+2} etc.) using AAS
4 Study of DC polarography / Cyclic voltametery of metals (Pb^{+2}, Cd^{+2}, Cu^{+2}, Hg^{+2} , As^{+2} etc.)
5 Column chromatographic separation of organic mixture and natural products

Solvent extraction

1 Uranyl nitrate from thorium nitrates with the help of tributyl phosphate
2 Separation of metal from a mixture
3 Study of the solvent extraction of Hg and Al with 8-hydroxyquinoline.

SEMESTER-IV

M 4 IC06 EP 02

(Practical-B-IV**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

Spectrophotometric estimation of drugs like:

1 Ciprofloxacin
2 Rifampicin
3 Metronidazole
4 Tinidazole
5 Paracetamol
6 Diclofenac sodium
7 Valsartin
8 Ketoprofen
9 Ibuprofen
10 Sodium chloride
11 Ambroxol
12 Sildenafil
13 Lacipidine
14 Tobramycin
15 Propantheline bromide
16 Clarithromycin
17 Efavirenz
18 Drotavarine
19 Pravastatin sodium

Formulation of pharmaceutical dosage forms like Suspensions, Emulsions, Creams, Ointments, Tablets and Capsules.