MADHYANCHAL
PROFESSIONAL UNIVERSITY

SYLLABUS:

M.Sc. APPLIED CHEMISTRY

SEMESTER-I

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted								Hours' per week			Total Credits	Remarks
			Theory				Practical								
			End Sem	Mid Sem. MST	Quiz, Assignment	Total Marks	Lab Work	Assignment /Quiz/Term paper	End Sem	Total Marks	L	T	P		
1.	**MACH 101**	PHYSICAL CHEMISTRY	60	20	20	100								4	**One credit refers to one hour teaching in theory,Tutorial**
2.	**MACH 102**	CHEMISTRY OF MATERIALS AND PROCESSES	60	20	20	100								4	
3.	**MACH 103**	TRANSITION METALS, CORROSION, & PROTECTIVE MEASURES OF METALS	60	20	20	100								4	
4.	**MACH 104**	ANALYTICAL CHEMISTRY	60	20	20	100	-	-	-					4	
5.	**MACH 105**	INORGANIC CHEMISTRY PRACTICAL					20	10	20	50				2	
6.	**MACH 106**	ORGANIC CHEMISTRY PRACTICAL					20	10	20	50				2	
7.	**MACH 107**	PHYSICAL CHEMISTRY PRACTICAL					20	10	20	50				2	
	Total		240	80	80	**400**	60	30	60	**150**				22	**650**

SEMESTER-II

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted								Hours' per week			Total Credits	Remarks
			Theory				Practical								
			End Sem	Mid Sem. MST	Quiz, Assignment	Total Marks	Lab Work	Assignment /Quiz/ Term paper	End Sem	Total Marks	L	T	P		
1.	**MACH 201**	CHEMISTRY OF HIGH POLYMERS	60	20	20	100								4	**One credit refers to one hour teaching in theory,Tutorial**
2.	**MACH 202**	ENVIRONMENTAL & GREEN CHEMISTRY	60	20	20	100								4	
3.	**MACH 203**	DRUGS AND PHARMACUTICAL CHEMISTRY –I	60	20	20	100								4	
4.	**MACH 204**	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS	60	20	20	100	-	-	-					4	
5.	**MACH 205**	INORGANIC CHEMISTRY PRACTICAL					20	10	20	50				2	
6.	**MACH 206**	ORGANIC CHEMISTRY PRACTICAL					20	10	20	50				2	
7.	**MACH 207**	PHYSICAL CHEMISTRY PRACTICAL					20	10	20	50				2	
	Total		240	80	80	**400**	60	30	60	**150**				20	**650**

SEMESTER-III

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted								Hours' per week			Total Credits	Remarks
			Theory				Practical								
			End Sem	Mid Sem. MST	Quiz, Assignment	Total Marks	Lab Work	Assignment /Quiz/ Term paper	End Sem	Total Marks	L	T	P		
1.	**MACH 301**	ORGANIC SYNTHESES	60	20	20	100								4	**One credit refers to one hour teaching in theory,Tutorial**
2.	**MACH 302**	CHEMICAL PROCESS INDUSTRIES AND TECHNOLOGY	60	20	20	100								4	
3.	**MACH 303**	CHEMISTRY OF NANOMETRIALS & COMPUTER FOR CHEMIST	60	20	20	100								4	
4.	**MACH 304**	SURFACE CHEMISTRY AND CATALYSIS	60	20	20	100	-	-	-					4	
5.	**MACH 305**	QUANTITATIVE ANALYSIS PRACTICAL-I					20	10	20	50				2	
6.	**MACH 306**	ORGANIC CHEMISTRY PRACTICAL					20	10	20	50				2	
	Total		240	80	80	**400**	60	30	60	**150**				20	**650**

SEMESTER-IV

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted								Hours' per week			Total Credits	Remarks
			Theory				Practical								
			End Sem	Mid Sem. MST	Quiz, Assignment	Total Marks	Lab Work	Assignment /Quiz/ Term paper	End Sem	Total Marks	L	T	P		One credit refers to one hour teaching in theory,Tutorial
1.	**MACH 401**	SPECTROSCOPIC METHODS OF ANALYSIS(ABSORPTION SPECTROSCOPY)	60	20	20	100								4	
2.	**MACH 402**	QUANTITATIVE ANALYSIS PRACTICAL-II					20	10	20	50				2	
3.	**MACH 403**	APPLIED CHEMISTRY PRACTICAL					20	10	20	50					
4.	**MACH 404**	DISSERTATION	60	20	20	100	-	-	-					4	
	Total		120	40	40	200	40	20	40	**100**				12	**300**

SEMESTER-I

MACH 101 PHYSICAL CHEMISTRY

UNIT-I

THERMODYNAMICS AND THERMODYNAMIC EQUILIBRIUM

Introduction, of thermodynamics and thermodynamic equilibrium.

First law of thermodynamic concept of internal energy, Joule Thorsen effect and its applications, Kirchoff equation and its applications.

Second law of thermodynamics, Carnot theorem and Carnot cycle. Physical concept of entropy & enthalpy, Gibb's-Helmholtz equation and its applications, thermodynamic derivation of law of mass action, Vant Hoft isotherm... Vant-Hoft isechare.. The Clapeyron equation, Clauscius Clapeyron equation and their applications. Third law of thermodynamics Nernst Heat theorem

UNIT-II

CHEMICAL KINETICS AND MECHANISM

Introduction of Chemical kinetics.(Order & molecularity) determination of reaction mechanisms: Arthenius equation, effect of temperature on rate constant, Energy of activation. collision and transition state theories of rate constants: Uni & Bi molecular reactions: enzyme kinetics: salt effects: homogeneous catalysis: oscillatory reactions (Belousov Zhabutinskii reaction). branching chain: H, O, reaction.

UNIT -III

PHOTO CHEMISTRY

Photo chemical reactions, & its kinetics, photo-stutionary state. Stark-Einstein Law of photo chemical equivalence, and quantum yield. Introduction to exact quantum mechanical results The Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model systems viz... particle in a box. the harmonic oscillator, the rigid rotor, the hydrogen atom. Hydrogen Molecule.

UNIT - IV

ADSORPTION AND ADSORPTION ISOTHERMS

Adsorption: (Physicorption and chemisoption factors affecting adsorption Freundlich dangmuir &Gibbs adsorption isotherm. BET Theory & estimation of surface area Micelles Surface active pents, classification of surface active agents, mivellization, critical micellar concentration (CMC), factors affecting the CMC of surfactants, Concepts of catalysis: Homogenous catalysis, Kindnes of enzyme reactions.

UNIT-V

COLLOIDS AND COLLOIDAL STATE

Classification Stability Preparation and properties of colloids: precipitation spontaneous ageing and coagulation of colloids optical and kinetic properties, electrical and electrn kinetic phenomment and applications of electro phoresis, Donnan membrane equilibrium and its applications.

Recommended Books:

1. Analytical Chemistry Principles and Techniques, L.G. Hargis, Prentice Hall, USA.

2. Instrumental methods of analysis, H.H. Willard, L.L. Merritt, Jr., J.A. Dean and F.A.

Settle, Jr., Van Nostrand Reinhold Co., New York

3. Principles of instrumental analysis, D.A. Skoog, W.B. Saunders Co., New York.

4. Vogel's Textbook of Quantitative An alysis, revised, J. Bassett, R. C. Denney, G. H.

Jeffery and J. Mendham, ELBS

5. Vogel's Textbook of Practical Organic Chemistry, A. R. Tatchell, John Wiley

MACH -102 CHEMISTRY OF MATERILS AND PROCESSES

UNIT-I

(A) CHEMISTRYOF BOILER FEED WATER: -industrial Boiler food Water problems and its

remedies walysis bed numerical problems

HOCHEMISTRY OF FUELS & GREEN ENERGY SOLUTION: General introduction, Classification of fuel, Combuation characteristics &.analysis of coal. Nuclear evergy & Nuclear Reactor, Green energy solution (Solár cell. Hydrogen Cell, Bio Dievel) Numerical problems based on analysis and combustion of coal.

UNIT-II

CHEMICAL KINETICS, IN UNIT PROCESSES:

Chemical Kinetics, Mochanism. Techniques of Nitration, Sulphonation, Halo-geration, Hydrogenation: Alkylation's, Oxidation, Hydrolysis.

UNIT-III

AGRO CHEMICALS AND FERTILIZER: -

Introduction to plant nutrients. Bio-Chemical nutrient function. Classification of Fertilizer. Pesticides. Insecticides, Manufacture of Ammonia. Ures, & Super Phosphate fertilizer, and its Major Engineering problems General Production of DDT, BHC, Gammaxene, Malathion, Parathion and Bio-Fertilizer.

UNIT-IV

A)LUBRICANTS :-Introduction classification mechanism, & Physice chemical analysis of lubricants

B) DYES - Classification of dyes base on their structure and application. Theory of colour and chemical constitution of Alizarin and Indigo their application to fiber.

C) UNIT REACTOR:- Basic Concepts of Mixtures, grinders, agitators, filters and evaporators used in industries. Types and shape of various reactors.

UNIT-V

SYNTHESIS OF ORGANIC MATERIALS:

Concepts in organic synthesis: Retro synthesis. linear and convergent synthesis. Asymmetric synthesis: methods of asymmetric induction -substrate, reagent and catalyst controlled reactinus: determination of enantiomeric and diastercomeric.

Recommended Books:

1.A guide book to mechanisms in Organic chemistry by Peter Sykes : ELBS.

2.Organic chemistry, Vol. I (6^{th} Edn.) and Vol. II (5^{th} Edn .) by I.L. Finar, ELBS.

3.Organic chemistry by Mukherjee, Singh and Kapoor, Vols. I.and II, Wiley Eastern

4.Reaction mechanism in Organic chemistry by Mukerjee and Singh, Macmillan India.

MACH-103 TRANSITION METALS, CORROSION, & PROTECTIVE MEASURES OF METALS

UNIT-1

TRANSITION METALS

General idea of First Series of Transitional elements, their characteristics industrial importance. Coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms. Redox chemistry, analytical applications.

UNIT-II

BASIC PRINCIPLES INVOLVED IN CORROSION: -

Concept of free energy dissolution processes, electro-chemical equilibria. Nerost theory of metal electrode potential immersed in a liquid initially free from its ions potential of metal forming two types of ions, Potential of a highly reactive metals, Zero potential electrode, types of Corrosion cells. Over Voltage polarisation electrode behaviour of various meis, cuthodicreactions and anodic reactions, chemical potentials and equilibrium, chemical potential and electrical work, free energy relationships.

UNIT-III

THE APPROACH OF CORROSION: -

Fundamentals of corrosion, types of cntrosion, chemistry and mechanism of currosion, factors involved in corrusion process. factors influencing corrosioni, classification and theories of corrosion Thermodynamics and chemical kineties of corrusion reactions characteristics of envircutents fatmosphere, water, soil, chemicals food stuff, fused salts microbcals in corrosion progress, corrosion behaviour of technological important metals, corrosion fatique, testing and measurement of rate of corrosion.

UNIT - IV

PASSIVITY OF METALS, INHIBITORS AND PASSIVATORS: - Concept of passivity and passivation. types & theory of passivity, mechanism of film nucleation and film growth break down passivity, passivation by electrical external current and chemical oxidising agents, inhibitors and passivators types. General principles governing inhibition mechanisin of inhibition. Cathodic protection and anodic protection problems and limitations, advantages and disadvantages of cathodic and anodic protection.

UNIT-V

COATINGS PERFORMANCE AND EVALUATION: -

Coatings, eletroplating technique used for nickel. cadmium, chromium plating, inorganic & Non-metallic.

Principle of prevention of corrosion, preparation of metal surfaces for coating. Method of applying metal coatings. Mechanism of film formation and application of oxide coatings on ferrous surfaces, vitreous enamel coatings, pigments used in coatings, wash primer system, evaluation of priming pigments factors influencing evaluation of paints, vanishes, enamels, and lacquers, functions of paint ingredicins.

Recommend Books:-

1.Advanced organic chemistry by Jerry March, Wiley Eastern.

2. Chemistry of Natural Products by K.W. Bentley (Editor).

3. Stereochemistry of carbon compounds by E.Eliel, McGraw –Hill.

MACH-104 ANALYTICAL CHEMISTRY

UNIT-I

GENERAL ANALYTICAL CHEMISTRY:

Importance applications & scope of analytical chemistry, classification of analytical methods classical and instrumental), selecting analysis method Sampling: Definition and purpose of sampling Sampling of gases. Ambient & stock sampling Sampling of solids & liquids techniques of weighing possible errors, calibration of glassware. sample preparation decompositions, safety measures in the analytical laboratory.

UNIT-II

TITRIMETRIC METHODS OF ANALYSIS

General principles of Volumetric analysis, concentration systems. Types of Volumetric Titrations Acid Rese Titrations, Oxidation-reduction, Complexameric. Precipitations theories, its applications and Numerical Non qucuus fitrations Choice of Indicators in different titrations.

UNIT -III

GRAVIMETRIC & THERMOGRAVIMETRIC ANALYSIS: -

Theory and procedure of gravimetric techniques analysis. Machines of precipitation nucleation, particle size, crystal growth, colloidal stage, nature condition and treatment of precipitation Co-precipitations, and ageing crystal lattice of precipitation organic precipitation precipitation from homogeneous solutions. washing, drying and ignition of ppt. Theory, instrumentation & application of thermo gravimetric & differential thermal Analysis. Thermometric and colorimetric analysis, thermal methods in quantitative analysis.

UNIT-IV

CONDUCTOMETRY AND CONDUCTOMETRIC TITRATIONS:

General principle of conductometry. instrumentation. electrolytic conductance and electrolytic concentration relationship conduclometric titrations including neutralisation precipitation oxidation reduction complexation and high frequency titrations other applications of analytical importance:

UNIT-V

POTENTIOMETRIC METHODS OF ANALYSIS:

Potentiometre principles and instrumentation concept of the difference in potential in potential between mo electrodes dipped in solution of ions. Types of electrodes effect of concentration of electrode putentials effect of complex formation on electrode potentials function of salt bridge cell voltage nieasurement by potentiometrically potentiometric titrations applied in connection with neutralisation precipitation oxidation-reduction and complexation systems. Advantages and limitaions of potentiometric methods. Application of em f'measurements to analytical chemistry.

Recommended Books:-

1.Inorganic chemistry, principles of structure and reactivity, 4thEdition by James E. Huheey: Elleu A. keiter: Richard L. Keiter.

2.Advanced inorganic chemistry by F.A.Cotton and G. Wilkinson.

3.Theoretical Inorganic Chemistry by Day and Selbin.

4.Concepts and Models in Inorganic Chemistry by Doughlas Mc Daniel.

5.Introductory Quantum Chemistry by A.K. chandra (Tata McGrawhill)

6.Chemistry of Lnathanides by T. Healler, chapman and Hall.

7.Chemical Applications of Group Theory by B.A. Cotton.

8.Basic concepts of Nuclear Chemistry by R.T. Overmann.

9.Introduction to Nuclear Science by M.N.Sastri, East West Press, Madras.

MACH-105: INORGANIC CHEMISTRY PRACTICAL

Synthesis

Preparation of inorganic complex compounds and their characterization:

Some suggested complex compounds

(1) VO(acac)2

(2) TiO(C9H8NO)2.2H2O

(3) cis-K[Cr(C2O4)2(H2O)2]

(4) Na[Cr(NH3)2(SCN)4]

(5) Mn(acac)3

(6) K3[Fe(C2O4)3]

(7) [Co(NH3)6][Co(NO2)6]

(8) cis-[Co(trien)(NO2)2]CI.H2O

(9) Hg[Co(SCN)4]

(10) [Co(Py)2CI2]

(11) [Ni(NH3)6]CI2

(12) Ni(dmg)2

(13) [Cu(NH3)4]SO4.H2O

References:

1.Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham,ELBS.

2. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall

MACH-106: ORGANIC CHEMISTRY PRACTICAL

Synthesis of Organic compounds

Synthesis, purification and characterization of about ten organic compounds involving one or two Stages.

List of some suggested compounds

1.β-Napthyl methyl methyl ether from β-Napthol

2.m-dinitrobenzene from Nitrobenzene

3.Azodye from aniline

4.Benzoic acid from ethyl benzoate

5.Benzanilide from aniline

6.P-nitroanilene from Acetanilide

7.P-Bromo acetanilide from aniline

8.Phthalimide from phthalic acid

9.1,2,3-Tribromo benzene from aniline

10. Banzanilde from Benzophenone

TEXT BOOKS

1 A text book of practial Organic chemistry by A.I. Vogel, ELBS and Longman group.

2.Practical Organic chemistry by Mann and Saunders, ELBS and Longman group

MACH-107: PHYSICAL CHEMISTRY PRACTICAL

List of Experiments:

1Critical Solution temperature of phenol-water system; effect of Electrolyte.

2.Equilibrium constant of KI $+I_2$-------KI_3.

3.Hydrolysis of an ester – A Kinetic study.

4.Dimerisation constant of benzoic acid by the distribution method (Benzene –water system).

5.Inversion of Surcrose –Akinetic study.

6.Conductometric titration of mixture of weak and strong acid with sodium hydroxide.

7.Determination of solubility product of a sparingly soluble salt by conductometric method.

TEXT BOOKS

1.Practical Physical Chemistry by Alexander.

2.Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham,ELBS

SEMESTER-II

MACH-201 CHEMISTRY OF HIGH POLYMERS

UNIT-I

POLYMER FUNDAMENTALS: -

Basic concepts of polymer science. Molecular forces and chemical bonding in polymer, classifiction of polymer, regular and irregular polymer Structure, chemical heterogeneity & molecular mass heterogeneity, polymolecularity, polarity and non-polarity in polymer. Tacticity of polymer.

UNIT-II

SYNTHESIS OF HIGH POLYMER & MECHANISM: -

Monomer functionality. Synthesis through functional group. multiple bonds and ring opening. Step and condensation polymerization, carbonyl addition-elimination, carbonyl addition substitution. Nucleophilic substitution reactions, double bond addition reactions, free radical coupling. Aromatic electrophilic substitution reactions, Molecular weight control in step polymerisation, Basic regularities of polymerisation, synthesis of graft and block copolymers. Addition Polymerization free radical, anionic. cationic and coordination reaction. Mechanism of vinyl and diene compounds, miscellaneous polymerisation reactions, Stereoisomerism in vinyl and diene polymers.

UNIT-III

PHASE SYSTEM FOR POLYMERISATION AND POLYMER STRUCTURE: Homogeneous system- Bulk, solution, Gas Phase Polymerisation. Heterogenes System-Suspension, Emulsion, Polymerisation Methods and its Advantage. Disadvantage. Chemical Structure determination. Vibrational. Raman & NMR Spectroscopy. Degradation of Polymer Thermol, Mechanical, Photo, High Frequency, Red ox, Anti Oxidants, Stabilizers, Biodegradable polymer mechanisan ot biodegradable and pharmaceutical application.

UNIT-IV

PHYSICAL PROPERTIES OF HIGH POLYMER: Average molecular weights determination, degree of polymerisation, poly dispersity, Crystallinity Glass transition temperature. practical significance of molecular weight and size Mechanical and other ultimate properties of polymer.

UNIT-V

PLASTICS:

Types, Chemical nature of plastics, contents of plastic compounds principles of processing of plastics. Manufacturing process of polyethylene. PVC. Bakelite,. Urea formaldahyde. General characteristics and properties of plastics. Technological importance of plastics.

RUBBER AND ELASTOMERS:

Chemical nature, sources, types, properties and uses of natural rubber. Manufacture of butadiene-styrene co polymerie, butadiene-acrylonirile co polymeric elastomers and their chemical reactions involved. Polyurethane rubber, rubber compounding, reclaimed rubber, reclaiming and reclaimed theory, vulcanisation and rubber technology.

Reference Books: -

1.Polymer science & Technology by Joel RFRIEDPTR Engle wood cliffr New Jercy 07632

2.Chemistry & Technology of Polymer by M.S. Bhatnagar. S. Chand & Comp, Ltd. New Delhi

3. Physical Chemistry of polymer by Tager Mir Publisher

4. Text book of polymer science by Billmeyer John wiley pub

5. Protective coating by Burns & Bradley Chemical Publisher

6. Polymer Chemistry by Poul CHiemeng Marcel Dekker I NR Pah

7. I undamental Principal of polymer material by Stephen Rosen Wiley International Pub & Polymer Sciej V.R.Couarker by New Age Inter Pub

MACH-202 ENVIRONMENTAL & GREEN CHEMISTRY

UNIT: I

FUNDAMENTALS OF ENVIRONMENTAL & GREEN CHEMISTRY :

Concept and scope of Environmental & Green chemistry. The 12 Principles of Green Chemistry. Designing safer chemicals, safer solvents & auxillaries. Design of Energy sufficiency. Reduction of derivatives. Design for degradation. Real time analysis for pollution prevention. Inherently safer chemicals for accident prevention.

UNIT-II

CHEMISTRY OF AQUATIC ENVIRONMENT: Chemical Composition of aquatic environment (solubility's of gases Oxygen, CO2 Alkalinity, nitrogen, silicon, phosphate, sulfur Cl, F and heavy metal in water) Redox equilibria in water complexation in water Micro organism, water pollution and trace level substance in water physico chemical and Biological analysis of waste water. Different case studies. Waste water treatment.

UNIT-III

CHEMISTRY OF AVIAN ENVIRONMENT:

The chemical Nature and composition of the Atmosphere, oxides of carbon, sulfur and Nitrogen in the atmosphere Organic pollutant and photochemical smog in the atmosphere. Inorganic pollutants and particular matter in the atmosphere. Monitoring and Analysis of Air pollution. Different case studies.

UNIT-IV

CHEMICAL TOXICOLOGY IN THE ENVIRONMENT:

Impact of Toxic chemical on Enzymes. Biochemical effect of arsenic, lead mercury cyanide, pesticides carcinogens. CO. NOS SON. O, & PAN. Legal aspect of Environment Water & Air pollution prevention Act. Environmental Impact Assesment (EIA).

UNIT-V

CHEMISTRY OF SOIL, & SOLID WASTE MATERIALS

The chemical Nature and composition of the soil, soil profile, sources of soil pollution, effect of urban and Industrial solid waste. Physico- Chemical analysis of soil. Radioactive pollution, Radiation chemistry source and effect of radioactive pollution, e-waste & remedies.

Reference Books: -

1. Environmental Chemistry by S.E. Manahan, Willgrd grant Press
2. Inorganic Chemistry by Wahid V. Malik, G.D. Tuli, R.D. Madan S.Chand Co. Ltd.
3. Cheinistry of the Soil- Firman Bear Oxford & IBI Pub.

4. Environment chemistry by B.K.Sharma & Miss H. Kaur
5. Chemistry and Biological Method for water Pollution studies by Goel & Trivedi Env Pub

MACH-203 DRUGS AND PHARMACUTICAL CHEMISTRY -I

UNIT-I

ALKALOIDS:

Introduction, classification, and General methods of determining structure of alkaloids including Atropine(Tropane), Morphine Opium (Phananthrene Alkaloid) General structure of purines & pyrimidines includes uric acid, caffine, Theobromine. Thiophylling properties and uses.

UNIT-II

STEROIDS & HORMONES: -

Introduction. Nomenclature, classification, & stercochemistry of steroids. Absolute configuration of steroids, sterols. Chemistry of cholesterol and Stigamosterol. Constitution, isolation & Function of bile acid. Introduction of Steroidal Hormones, Chemistry of Testesterone, Estrogen, and progesterone.

UNIT-III

Isolation & classification of proteins, Fibrous & Globular proteins. Methods of synthesis properties and classifications of amino acids, Nucleotides. General study of Nitrogen based nucleic acids. Non protein.

PROTEINS & AMINO ACIDS: -

Amino Acid, Chemical bonds in protein. Structure of protein.

UNIT-IV

BIOCHEMISTRY & BIOSYNTHESIS:

Bio-chemistry and its importance in pharmaceutical science, Bio-chemical organization) cell energy ATP and its biological significance. Enzyme, Carbohydrate. Lipid. Amino acid and Proteins and Nucleic acid Metabolism, Biosynthetic of carbohydrade, Stools, free plant pigment, terpenoids.

UNIT-V

PHARMACEUTICAL BIOTECHNOLOGY:

Enzyme Immobilization. Fementors and Bioreactors, Mirobial trans formation, Improvement of microbial strain, Genetics DNA & RNA polymerase, special characters of DNA. Application of Recombination DNA technology in different field.

Reference Books: -

1. Chemistry of Natural Products Vol. 1.II O.P.Agarwal Goel Pub, Mecrut

2. Chemistry of Natural Product Vol. III Chatwal, Anand, Himalaya Pub.

3. Pharmaceutical Chemistry Jayshree Ghosh S.Chand Pub

4. Fundamentals of biochemistry J... Jain. S.Chand Pub.

5. Medicinal chemistry by Ashutosh Kar. Wildy eastern Ind

6. Medicinal chemistry Vol. I. II by Alferd Burgir Wiley Inter. Pub

7. Synthetic Drugs by Chatwal Anand, 1timalaya pub

MACH-204 INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS.

(ELECTRO-ANALYTIC & CHROMATOGRAPHIC)

UNIT-I

SOLVENT EXTRACTION:

Basic principle of solvent extraction (Distribution law). Factor affecting extraction. Techniques of extraction, Quantitative treatment of solvent extraction equillibria. classification & types of solvent extraction system, mechanism of extraction, advantages & application in analytical chemistry. Introduction of counter current extraction. Craigg's technique & its application.

UNIT-II

VOLTAMMETRY POLAROGRAPHY AND AMPEROMETRIC TITRATIONS: -

General principle and instrumental set-up of polarograph important features of DME, concepts and expression of diffusion current Ilkovic equation half wave potential residual current, current-potential curves and reversible reactions. Applicaions for characterising organic compounds. Differential pulse polarography. Analytical applications of polarography, Fundamental principles of amperometric titrations instrumentation and titration procedures advantage and disadvantages of amperometric titrations.

UNIT-III

NEPHELOMETRY, TURBIDIMETRY PHASPHORESCENCE AND FLUORESCENCES: Principles of nephelometry and turbidimetry, their instrumental set-up, effect of concentration, particle size and wavelength on scattering of light. Application to analysis. Theory of florescence and phosphoresce, instrumental requirements, interpretation of fluorescence and phosphorescence spectra. factors affecting fluorescence and phosphorescence relation between fluorescence intensity and concentration application as analytical tools and their comparision.

UNIT-IV

CHROMATOGRAPHY I

Introduction, theory & classification of chromatography, retention time, relative retention time. Fronting tailing, band broadening & columo efficiency, applications of chromatography in qualitative and quantitative analysis.Chromatography. paper, thin layer and column.

UNIT-V

CHROMATOGRAPHY II

Instrumentation of GC. & its solvents, HPLC. GC-MS LC-MS, UPLC. and their Chromatographic interpretation. Differences between GC and HPLC, lon chromatography. with reference to their specialized analytical applications.

Reference Books:

1. Instrumental Methods of Chemical Analysis Will and Letton Edu Pub. Lid New York.

2. Instrumental Methods of Chemical Analysis Chatwal Anand. Himalaya.

3. Spectroscopy of Org. Pub Compounds P.S.Kalsi, New Age Inter, Pub.

4. Instrumental Methods of Chemical Analysis B.K. Sharma. Coel Pub. Mecrut.

5. Instrumental Methods of Chemical Analysis H. Kaur. Pragati Pub 6. Instrumental Methods of Chemical Analysis by Golen W. Ewing McGraw Hill.

7. Hand book of Chromatography for Chemist & Engineers

MACH 205: INORGANIC CHEMISTRY PRACTICAL

Experiments:

- Analysis of inorganic salt mixtures (minimum four mixtures)
- Semi-micro qualitative analysis of six radical mixtures containing one interfering radical and one less familiar cation each.
- Study of Systematic procedure
- Spot tests.

Text Books

1.A text book of Practical Inorganic Chemistry by AI Vogel, ELBS

2.Laboratory manual of Engineering Chemistry by Dr Sudha rani

MACH 206: ORGANIC CHEMISTRY PRACTICAL

Experiments:

Identification of unknown organic compounds: (Single compound)

Systematic identification of organic compounds –preliminary examination , detection of extra elements ,solubility ,common functional group tests ,functional group tests (determination of two functional group in a single component ,if at all present),preparation of two rational derivatives.

The given organic compound must be identified by checking the melting point /Boiling point of the compound and melting points of its derivatives with the literature.

List of suggested compounds

Glucose, Fructose , Benzaldehyde ,Para anisaldehyde ,P-Chloro benzaldehyde ,Acetophenone ,Phenol ,cresols, Naphthols ,Benzoic acid ,P-Chloro Benzoic acid ,aniline , p-tolune,p-anisidine ,P-chloro aniline ,diphenyl amine ,N.N-dimethyl aniline ,Benzamide ,Naphthalene ,and Anthracene .

Text Books:

1.A text book of practial Organic chemistry by A.I. Vogel, ELBS and Longman group.

2.Practical Organic chemistry by Mann and Saunders, ELBS and Longman Group

3.Organic analytical Chemistry –Jagmohan

MACH 207: PHYSICAL CHEMISTRY PRACTICAL

List of Experiments:

1.Formula of Cuprammonium cation –distribution method.

2.Heat of Neutralisation.

3.Heat of solution.

4.A study of the adsorption of oxalic acid on charcoal.

5.Study of binary liquid mixture involving azeotrope.

6.Study of a two component system involving eutectic or compound formation.

7.Phase diagram of a three component system (chloroform –acetic acid – water)

Text Books

1.Practical Physical Chemistry by Alexander.

2.Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.

SEMESTER-III

MACH 301 ORGANIC SYNTHESES

UNIT-I

FORMATION OF CARBON –CARBON SINGLE BONDS :

Alkylation via enolate, the enamine and related reactions, umploung (dipole inversion) – the aldol reaction –applications of organo palladium , organo nickel and organo copper reagents-applications of α-thiocarbanions, α- selenocarbanions and sulphur ylids -synthetic applications of carbenes and carbenoiods.

UNIT-II

FORMATION OF CARBON –CARBON DOUBLE BONDS**:**

β-Elimination reactions, pyrolytic syn eliminations, sulphoxide –sulphenate rearrangement- the wittig and related reactions- alkenes from arylsulphonylhydrazones –claisen rearrangement of allyl vinyl ethers.

Reactions of unactivated carbon-hydrogen bonds: The Hoffmann-Loeffler –Freytag reaction – The Barton reaction –Photolysis of organic hypohalites.

UNIT-III

SYNTHETIC APPLICATIONS OF ORGANO BORANES AND ORGANO SILANES:

Organo boranes : Preparation of organo boranes viz hydroboration with BH_3 –THF ,dicylohexyl borane , disiamyl borane ,thexyl borane ,9-BBN and di-isopinocampheyl borane.Functional group transformations of organo boranes: oxidation ,protonolysis and rearrangements .Formation of carbon - carbon bonds viz organo boranes carbonylation ,the cyanoborate process and reaction of alkenyl boranes.

Organo silanes : Synthetic applications of trimethylsilyl chloride, dimethyl –t-butylsilyl chloride, trimethylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate. Synthetic applications of α-silyl carbanions and β-silyl carbonium ions. Phase transfer catalysis –principle and applications.

UNIT-IV

Oxidation : Oxidations of hydrocarbons , alkenes , alcohols aldehydes and ketones oxidative coupling reactions . Use of $Pb(OAc)_4$, NBS, CrO_3 ,SeO_2 , MnO_2 , alkoxyluphonium salts, $KMnO_4$,OsO_4 , RuO_4 , peracid and Tl(III)nitrate .

UNIT-V

Reduction: Catalytic hydrogenation(homogeneous and heterogeneous),reduction by dissolving metals , reduction by hydride transfer reagents, reduction with hydrazine and diimide ,selectivity in reduction of nitroso and nitro compounds , reductive cleavage.

Design of Organic synthesis : Retrosynthesis-the disconnection approach –basic principles convergent and linear synthesis .

SUGGESTED BOOKS FOR READING

1.Modern Methods of Organic Sysnthesis by W.Carruthers

2.Modern Sysnthetic Reactions by H.O.House

3.Organic Sysnthesis by Robert & Ireland

4.Designing Organic Sysnthesis by B Staurt Warron

5.Organic Sysnthesis by S.Warrant

MACH-302 CHEMICAL PROCESS INDUSTRIES AND TECHNOLOGY

UNIT-1

REACTION MECHANISM OF ORGANIC REACTIONS:

Basic ideas of reaction classification and general mechanism of carbonia-jons, free adical Nucleophilic substitution at saturated carbon Mechanism SN and SN reaction Electrophilic substitution at saturated carbon atom SE SE SE'Mechanism, Aromatic nucleuphilic substitution SAr mechanism Diazo coupling Raw material, chemical reaction and flow sheet diagram of manufacturing process of phenol, styrene, acetic acid, glycol and glycerol.

UNIT-II

MECHANSIM OF MOLECULAR REARRANGEMENT:

Cinsification and general mechanism of cleophilic, electrophilic Free radical molecular rearrangement. Out line of mechanism and application of the following reagement pinucal-pinacolane Beslic acid, fimorskit, hotmann claisan & fries rourrangement. Pericyclic reactions. electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions.

UNIT III

PULP. PAPER AND TEXTILE TECHNOLOGY:

Introduction chemistry of pulping, bleaching Manufacture of Rayon and paper pulp Production of paper. Natural and synthetic fibers Manufacture of textile fiber ie viscous cupra annun rayou nylon polyester, acrylic & poly propylene.

UNIT-IV

OILS, FATS, SOAP TECHNOLOGY: Introduction chemistry of oils fats and soaps, Chemistry of extraction, refining and bleaching of oil.

Manufacture of soyabeen and cotton seed oil. Extraction of essential oil. Physico chemical properties and test of oit, fats and soap Manufacture of anionic, catioisio, anionic &ampholytic surfactances production of difference types of soup.

UNIT-V

FERMENTATION AND SUGAR TECHNOLOGY

Introduction Conditions for Fermentation Equipment Media preparation Growth phase & Enge Functions Account of Some Fermentation processes Manufacture of Alcoholic beverages Manuficie of Vinegar. Manufacture of Lactic Acid. Manufacture of Citric Acid Introduction of sugar technology Manalacture of Cane Sugar, recovery of secrose form molasses preparation of Celotes. Physico chemical properties and testing of Sugar and its intermediate Sugar industry in India.

Reference Books:

1. Chemical Process fodistries-RN Shrinivas, Mc Graw Hill Pub

2.Outline of Chemical Technology - Degiden. Att ated cd west Press Pst. Lit

3. Imoduction to Chemical Engineering-edger. Tata Me Graw Hill Pab LB Chemical-J

4. Jain. S.Chand Co. Lat.

5. Chemical Tech Part II & IV Published IT Masinis

6. Industrial Chemistry-B.K.Shanna, God b

7. Manufacture of Pulp and Paper Tela Brite CBS Pub

8. Dycing Chemical Technology of Tile Fibers Tioman Chales Griffs & COLM

MACH-303 CHEMISTRY OF NANOMETRIALS & COMPUTER FOR CHEMIST

UNIT-1

CHEMISTRY NANO MATRIALS:

Nano particles formation and modeling in dispesse liquid systems. Nano composites of carbon nano particles in polymer films bio based nano composites synthetics and characterization of nano coatings by electro less & sputter coating techniques by gas reduction and mechanical alloying routes interfacial engineering of carbon nanotubes and application inorganic membrane. reduction. Meerwein-Ponndorf-Verley reduction, Wittig reaction.

UNIT-II

SMARTS CHEMICALS: -

Introduction smarts structures polymeric gels biopolymer gel and electro active polymer. Sap memory alloys & polymer. Tissue engineering and smart materials biomaterials, application of smart structure.

UNIT-III

SUPRAMOLECULAR CHEMISTRY:

Concept of supramolecular chemistry, molecular recognition, nomenclature, design of supramolecular through non-covalent interactions and their applications in transport processes.

UNIT-IV

COMPUTER FOR CHEMIST:

Basic structure and functioning of computers, memory 1/0 devise secondary storage, computer languages DOS operating system. Introduction to UNIX and WINDOWS, Data processing principle of programming. Flow chants. Algorithms and exposure of the packages such as MATLAB & MSWORD. Elementary idea of Computer Aided Drug Designing (CADD).

UNIT-V

COMPUTATIONAL CHEMISTRY: A brief outline of molecular mechanics, semi-empirical approximations, ab initio methods, basis sets and Z-matris: Application of these computational methods for prediction of structural and electronic properties of molecules by using standard programs.

Reference Books: -

1.C Cramer, Essentials of Computational Chemistry: Theories and Models, John Wiley & Sen, 2002

2.D. Young, Computational Chemistry A practical Guide for applying Techniques to Real World Problem, Wiley Interscience. 2001.

3. Programming in ANSIC by Balaguru Swami.

4. Smurt Chemical and Nano imateria), by PK. Data

MACH-304 SURFACE CHEMISTRY AND CATALYSIS

UNIT-I

SURFACE PHENOMENA:

Structure of clean surfaces; Notation of surface structure; Structure of adsorbate layers; Stepped surfaces; Surface relaxation and reconstruction; Dynamics and energetics of surfaces.

UNIT-II

ADSORPTION:

(a)Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), (b) Adsorption at interfaces- at solid/liquid, liquid/gas and liquid/liquid interfaces; Gibbs adsorption isotherm, effect of electrolyte on the surface energy of ionic surfactants, estimation of surface area (BET equation), surface films on liquids (Electro-kinetic phenomenon), catalytic activity at surfaces.

UNIT-III

SURFACE ACTIVE AGENTS:

General structural features and behavior of surfactants; classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization - phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

UNIT-IV

HETEROGENEOUS CATALYSIS:

Adsorption isotherms, surface area, pore size and acid strength measurements; acidic/ basic sites; Porous solids; Catalysis by metals/metal-oxides, semiconductors and solid acids; Supported metal catalysts; Catalyst preparation, deactivation and regeneration. Model catalysts: Ammonia synthesis; Hydrogenation of carbon monoxide; Hydrocarbon conversion.

UNIT-V

INSTRUMENTAL METHODS OF CATALYST CHARACTERIZATION:

Diffraction and thermal methods; spectroscopic and microscopic techniques.

Reference Books:

1. D.K. Chakrabarty and B. Viswanathan, Heterogeneous Catalysis, New Age, 2008.
2. G.A. Somorjai, Y. Li , Introduction to Surface Chemistry and Catalysis, Wiley, 2010.
3. Physical chemistry of surfaces by Arthur W. Adamson 1990
4. Chemical kinetics and catalysis by R.I. Masel, Wiley-Interscience, 2001.

MACH 305 QUANTITATIVE ANALYSIS PRACTICAL-I

VOLUMETRIC ANALYSIS

1.Preparation of vanadium(V) from ammonium metavanadate and standardisation of vanadium(V) with iron(II)

2. preparation of cerium (IV) sulphate from cerium(IV) oxide and standardization of cerium (IV) sulphate with iron(II)

3.Estimation of iron(III) by photo chemical reduction method.

4.Analysis of iron(III)-iron(II) present in a synthetic mixture (stannous chloride method).

5.Estimation of copper(II) present in a brass sample (iodometric method)

6.Determination of chromium(IV)present in a sample of potassium dichromate.

7.Determination of calcium hardness and magnesium hardness of water sample.

8.Determination of zinc a ferrocyanide.

9.Determination of chloride in a sample of water(silver nitrate method).

Text Books

1.A text book of Practical Inorganic Chemistry by AI Vogel, ELBS

2.Laboratory manual of Engineering Chemistry by Dr Sudha rani

MACH 306 ORGANIC CHEMISTRY PRACTICAL

ORGANIC MIXTURE ANALYSIS

1.Separation of organic compounds of a mixture (minimum of four mixtures)

2.Systematic identification of the separated organic compounds by functional group analysis, chemical reaction.

3.Separation of organic compounds of a mixture by TLC

Text Books

1. A Text book of practical organic chemistry, A.I. Vogel, ELBS.

2. Laboratory Manual of Organic Chemistry by Raj K Bansal

SEMESTER-IV

MACH-401 SPECTROSCOPIC METHODS OF ANALVSIS (ABSORPTION SPECTROSCOPY)

UNIT-I

ATOMIC ABSORPTION SPECTROSCOPY :

Principles, Instnitticiital set-up and. analytical procedure of absorption spectroscopy. Precision accuracy of atomic absorption spectroscopy. Relation between atomic absorption and flame emission and spectroscopy. Applications.

UNIT-II

MOLECULAR SPECTROSCOPY:

Interaction of electromagnetic radiation with molecular system, absorption and emission of radiation. classical and quantum mechanical treatments of vibration rotation of diatomic molecule. Theory of rotational spectrum. Application of rotational spectra to structure determination, Vibrational spectra of triatomic molecule, vibrational spectra of bonds, Electronic spectra, potential energy curve, Franck condon principle. Electronic states and spectra of poly-atomic molecules, Electronic sepctra and molecular orbital method. Electronic absorption spectra of mono di and ploysulphides.

UNIT III

COLORIMETRY AND SPECTROPHOTOMETRY (VISIBLE):

Principles and basic laws. Instrumentation and technique of analysis such as titrations. Composition of coloured complexes, Construction of photoelectric spectrophotometers and their comparison with colorimeters advantages of spectrophotometer. Applications of absorption spectra of solutions and liquids in measuring concentrations of different solution, in the studies of complex compounds and in determi ation of para and ortho forms of hydrogen molecules.

UNIT-IV

ULTRA-VIOLET & INFRA RED SPECTROSCOPY :

Instrumentation, sample handling' techique, basic principles with definition of some terms like of UV absorption bands, characteristic absorption of organic compounds, wood wards rules, interpretation and general application of U.V. spectroscopy in the elucidation of molecular structures. Instrumentation principles and experimental technique of IR. spectroscopy. Interpretation of IR spectra associated with structural changes. Structural diagnosis qualitative and quantitative applications.

UNIT-V

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY:

Theory of NMR with mathematical formulations. Instrumental, set-up and its mode of operation chemical shift equivalent and non-equivalent protons, spin-spin splitting structural information of organic compound information of stereo-chemical configuration of Viny polymers N.M.R. spectral characteristics. Structural elucidation by joint applications of UV IR,NMR and mass spectroscopy. General approach and work examples.

Reference Books:

1. Instrumental Methods of Chemical Analysis by Willard, East West Press Pvy.Ltd. 2. Instrumental Methods of Chemical Analysis by Galen W. Ewing Mc Graw Hill Pub.

3. Instrumental Methods of Chemical Analysis by Chatwal & Anand, Himalaya Pub.

4. Instrumental Methods of Chemical Analysis by B.K.Sharma, Goel Puh. House Meerut.

5. Fundamental of Molecular spectroscopy by C.N. Barwell, Tata Mc Graw Hill Co. Ltd... 6. Inorganic Quantitative Analysis by Bassett, E LBS Pub.

7. Spectrometric Identification of Organic Compounds by Silverstein Bassler & Morrill, John Wiley 8. Organic Chemistry by T.M. Graham Solomons & Craig B. Fryhle, Jhon wiley & Sons New York

MACH 402 QUANTITATIVE ANALYSIS PRACTICAL-II

POTENTIOMETRY

1.Estimation of Iron (II) with chromium (VI) .

2.Estimation of Iron (II) with cerium (IV) .

3.Estimation Vanadium (V) with Iron (II) .

P^H METRY

4Titration of a strong acid against a strong base.

5.Titration of a weak acid against a strong base .

6.Titration of a mixture of weak acid and a strong acid against a strong base.

Text Books:

1.A text book of Practical Inorganic Chemistry by AI Vogel, ELBS

2.Laboratory manual of Engineering Chemistry by Dr Sudha rani

MACH403 APPLIED CHEMISTRY PRACTICAL

Estimations

1.Determination of saponification value ,Iodine value and Acid value of an Oil.

2.Estimation of Glucose.

3.Determination of Glucose in Jaggery and Honey.

Preparations

4 .Preparation of Soap.

5. Preparation of cold Cream.

6 .Preparation of Shampoo.

Text Books

1.A Text book of practical organic chemistry, A.I. Vogel, ELBS.

2.Laboratory Manual of Organic Chemistry by Raj K Bansal

MACH404 Dissertation

- **Industrial Visit**
- **Industrial Training Report**

- Four weeks duration in any industry / chemical R&D / organization
- Each candidate have to submit a project report after completion.