NIMS UNIVERSITY

SYLLABUS

OF

MASTER OF SCIENCE (CHEMISTRY) – MSCCHM

VERSION 1.2

DIRECTORATE OF DISTANCE EDUCATION

Shobha Nagar, Jaipur-Delhi Highway(NH-11C), Jaipur- 303121
Rajasthan, India

MASTER OF SCIENCE (CHEMISTRY) – MSCCHM

Eligibility	:	Graduate in related fields
Programme Duration	:	2 Years
Programme Objectives	:	Our Master of Science programme is a versatile degree that provides students with the optimal balance between a defined sequence of study and flexible course options. This innovative program has been redesigned to develop graduates with the key practical skills and interdisciplinary knowledge required to address today's global challenges. Chemistry, being a central science, encompasses the synthesis and study of molecules and materials, the exploration of their properties and the development of ways to use them in real life. You will get an understanding of the mechanisms of reactions and processes that occur at the molecular level. Our unique programme will give you an understanding of the principles of chemistry, which further underline disciplines such as biochemistry, engineering, food science, materials science, nanotechnology and pharmacy.
Job Prospects	:	Our M.Sc. in Chemistry degree is one of the most versatile degrees you can obtain because of the fundamental nature of the discipline, and also because it can be combined with so many other sciences, leading to powerful and sought-after skills. After the completion of our programme, you will find a challenging career in the pharmaceutical industry, environmental testing, or forensic science laboratories. You may work in universities, scientific institutes, government or the private sector. Becoming a chemistry teachers is an equally attractive career. In addition, you may be employed in diverse roles in private companies, local councils, state and central government agencies, universities and hospitals. Common job profiles of students after completing M.Sc. in Chemistry include: Environmental Chemists, Analytical Chemists, Research Chemists and Chemistry Teacher (academic positions).

YEAR I

Course Code	Course Title	Theory/ Practical	Continuous Assessment (Internals)	Credits
CHM16101	Inorganic Chemistry-I	70	30	4
CHM16102	Organic Chemistry-I	70	30	4
CHM16103	Physical Chemistry-I	70	30	4
CHM16104	Analytical Chemistry-I	70	30	5
CHM16105	Group Theory and Spectroscopy	70	30	4
CHM16106	Environmental Chemistry	70	30	4
CHM16107	Industrial Chemistry	70	30	4
CHM16101P	Inorganic Chemistry-I	35	15	1
CHM16102P	Organic Chemistry-I	35	15	1
CHM16103P	Physical Chemistry-I	35	15	1
			Total	32

YEAR II

Course Code	Course Title	Theory/ Practical	Continuous Assessment (Internals)	Credits
CHM16201	Medicinal Chemistry	70	30	7
CHM16202	Nuclear & Radiochemistry	70	30	6
CHM16203	Chemistry of Natural Products	70	30	7
Any two of the following				
CHM16204	Organic Chemistry-II	70	30	5
CHM16205	Analytical Chemistry-II	70	30	5
CHM16206	Inorganic Chemistry-II	70	30	5
CHM16207	Physical Chemistry-II	70	30	5
Practical will be driven based on above selections				
CHM16204P	Organic Chemistry-II	35	15	1
CHM16205P	Analytical Chemistry-II	35	15	1
CHM16206P	Inorganic Chemistry-II	35	15	1
CHM16207P	Physical Chemistry-II	35	15	1
			Total	32

DETAILED SYLLABUS

INSTRUCTIONAL METHOD: Personal contact programmes, Lectures (virtual and in-person), Assignments, Labs and Discussions, Learning projects, Industrial Training Programmes and Dissertation.

YEAR I

INORGANIC CHEMISTRY-I– CHM16101

UNIT	CONTENTS
1	**Stereochemistry and Bonding in Compounds:** Introduction to Covalent Bond, Valence Bond Theory (VBT), Types of overlapping. Molecular Orbital Theory (MOT) -Basic Principles of MOT, Salient features of Molecular Orbital, Relative Order of Energy, Conditions for the Combination of Atomic Orbitals. Energy level diagram for molecular Orbital's, Molecular Orbital Configuration of Some Homonuclear Diatomic Molecules, Molecular Orbital Configuration of Some Hetero Nuclear Diatomic Molecules, Molecular Orbital Configuration of some Triatomic Molecules, Energy Required to Remove the Electron from AO and MO, Comparison of VBT and MOT, Shapes of covalent compounds, Valance Shell Electron Pair Repulsion (VSEPR) Theory, Shapes of molecules having regular geometry, Shapes of Molecules having Irregular Geometry.
2	**Co-ordination Compounds**: Classification of co-ordination compound, Werner's theory of co-ordination, Nomenclature of co-ordination compounds, Isomerism, Chelation, Facts influencing the stability of metal chelates, Cause of distortion.
3	**Electronic Spectra and Magnetic Properties of Transition Metal Complexes**: Selection rules for electronic transitions, Electronic spectra of transition metal complexes, Charges transfer spectra, Spectroscopic methods, Oxidation state of central metal atom, Types of transition.
4	**Metal – π Complexes:** General methods of preparation, General properties, Reductive elimination reactions, Substitution reaction, Structure of metal carbonyls, Structures of co-molecule, Molecular orbital model, Metal carbonyls Halides, Uses of carbonyls.
5	**Metal Clusters:** Carbonyl clusters, Electron counting scheme for HNCCS, Halide type cluster, Tetra nuclear clusters, Boron Hydrides, Non-volatile boranes, Differences between diborane and ethane, Structure clusters of diborane, Nature of bonding in hydrogen – bridge, Structure and bonding in some higher boranes, Metallocarboranes.
6	**Inorganic Polymers:** General characteristic of inorganic polymers, Phosphonitrilic compounds of Phosphazenes, Silicates, Silicates containing chain anions, Silicones, Polymerization of the intermediate, Silicone rubbers or Elastomers, Isoland hetero poly acids.
7	**Nuclear Chemistry-**The nature of the Nucleus, Nuclear binding energy, Isotopes, Iso bars, Isotones and Isomers, Natural radioactivity, Radioactive equilibrium, Wilson's cloud chamber, Nuclear fission, Atomic reactor or nuclear reactor, Working of nuclear power station.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Basic Inorganic Chemistry : Albert Cotton

ORGANIC CHEMISTRY-I – CHM16102

UNIT	CONTENTS
1	**Nature of Bonding in Organic Chemistry:** An introduction to Molecular Orbital formation, Type of overlapping, Theory of resonance, Huckel molecular orbital theory, Conjugated systems, Pertuberation Theory, Hyper conjugation, Aromaticity, Catenanes and Rotaxanes.
2	**Stereo Chemistry:** The concept of Isomerism, Different kinds of Isomerism with special reference to stereo Isomerism, Stereo isomerism, Chirality and Enantiomers, Representation of three dimensional molecular, Elements of symmetry, Nomenclature of organic compounds, Concept of Isosteric isomerism, Geometrical Isomerism, Different kinds of Confirmation.
3	**Reaction Mechanism:** Elementary and the simple reactions, Transition State Structure, Molecularity, Reaction Profile diagram, Thermodynamics of the reaction, Kinetic of a reaction, Methods of determination of reaction mechanism, Hard and soft acids and bases, Reaction intermediates.
4	**Nucleophilic Aliphatic Substitution:** Nucleophilic aliphatic substitution – An introduction, SN1 mechanism, SN2 Mechanism, Neighboring Group Mechanism, Mixed SN1 and SN2 mechanisms, Factors affecting reactivity in SN Reactions, Nucleophilic substitution of an allylic carbon, Ambidrient Nucleophiles, Regioselectivity, Ambidient substrates.
5	**Electrophilic Aliphatic Substitution:** An introduction to aliphatic Electrophilic substitution, SE1 mechanism (unimolecular mechanisms), SE2 Mechanism (Bimolecular mechanism), Halogenation of Aldehydes and Ketones, Halogenation of Carboxylic acids and Acyl Halides, Halogenation of Sulphoxides and Sulphaner, Aliphatic Diaxonium Coupling, Diazo Transfer reaction, Nitrosation at Carbon, Nitrosation at Nitrogen.
6	**Electrophilic Aromatic Substitution:** Arenium Jon Mechanism, Energy profile for a typical aromatic electrophilic substitution reaction, mechanism of same typical aromatic electrophilic substitution reaction as nitration, sulfonation, halogenations, Friedal craft acylation and alkylation, Orientation and Reactivity in Monosubstituted Benzenes, Steric effects in aromatic electrophilic substitution, Introduction of third group into the Benzene ring, Some important name reactions involving aromatic electrophilic substitution reaction.
7	**Nucleophilic Aromatic Substitution:** An introduction to Aromatic Nucleophilic substitution (ArSN), ArSN1 reaction mechanism, ArSN2 reaction mechanism, Aromatic Nucleophilic substitution reaction in a benzenes (Arynes), SRN1 mechanism, Factor effecting reactivity in aromatic Nucleophilic substitutions, Some important reactions involving Aromatic NucleophilicSubstitution Mechanism.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Advanced Organic Chemistry :Reactions, Mechanism and Structure, Jerry March,John Wiley.

B. Advanced Organic Chemistry :F.A. Carey and R.J. Sunderg, Plenum.

C. A Guide Book to Mechanism in Organic Chemistry : Peter Sykes, Longman.

D. Structure and Mechanism in Organic Chemistry :C.K. Ingold, Comell University Press.

PHYSICAL CHEMISTRY-I – CHM16103

UNIT	CONTENTS
1	**Quantum Mechanics:** Wave theory of matter, Heisenberg's uncertainty principle, The wave equation, Schrodinger wave equation, Eigen values and Eigen functions, Mathematical consiuation of Schrodinger Wave equation, Particle in a three – dimensional equation, Linear harmonic Oscillator, Wave mechanical treatment of hydrogen atom.
2	**Angular Momentum:** Angular momentum operators, Commutation relations, Eigen values of angular momentum, Ladder operators for angular momentum, Spin angular momenta, Helium atom and Pauli's exclusion principle, The Pauli's principle.
3	**The First law of Thermodynamics:** Various terms used in Chemical Thermodynamics, Energy concept, Nature of work and heat, Zeroth law of thermodynamics, First law of thermodynamics, Heat capacity, Application of first law of thermodynamics, Joule – Thomson effect.
4	**Entropy and Second Law of Thermodynamics:** Spontaneous and non-spontaneous processes, Reversible process, Cycle process and concept of Carnot cycle, Second law of thermodynamics, Carnot's theorem, Heat engine, Concept of Entropy, Free energy and work function, Criteria of spontaneity and conditions of equilibrium.
5	**Third Law of Thermodynamics:** Third law of Thermodynamics, Comparison of Nernst's heat Theorem with Third Law of Thermodynamics, Concept of residual entropy, Application of third law of Thermodynamics, Entropies of real gas, Use of third law of Thermodynamics.
6	**Chemical Kinetics:** Introduction to Chemical Kinetics, Reaction velocity and the factors affecting it, Velocity constant or rate constant, Order of reaction, Molecularity, Difference between order of reaction and Molecularity, Pseudo-molecular reactions, Methods of determining Rate Laws, Determining order of the Reaction, Arrhenius Equation, Activation Energy and Chemical Reaction.
7	**Ionic Reactions and Kinetic Salt Effects:** Ionic reactions, Theories of reaction rates, Collision theory to unimolecular reactions, Lindemann's theory, Transition state theory.
8	**Adsorption:** Surface tension, Gibbs Dividing Plane, Curved surfaces, Capillary action, Vapour pressure of droplets – Kelvin equation, adsorption, Measurements of adsorption, Factors affecting adsorption, Types of adsorption, Adsorption ISO theories.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Quantum Chemistry: Ira N. Levine, Prentice Hall.

B. Physical Chemistry:P.W. Atkins, ELBS.

C. Introduction to Quantum Chemistyry:A.K. Chandra, Tata McGraw Hill.

ANALYTICAL CHEMISTRY-I –CHM16104

UNIT	CONTENTS
1	**Role of the Analytical Chemistry:** Introduction to Analytical Chemistry, Classification of Analytical Method, Difference between Classical and Instrumental Methods, Factors affecting the choice and selection of Analytical Method, Cleanliness and neatness in Analytical Laboratory, Analytical balance, Errors in weighing, Cleaning of Glasswares, Preparation before Calibration Operation, Sample decomposition and dissolution, Application of Microwave decomposition, Gravimetric techniques.
2	**Errors and Evaluation:** Introduction to errors and evaluation, Central value or average value, Mean, Arithmetic mean of grouped data, Median, Precision, Expression of accuracy, Determination of accuracy, Types of errors, Significant figures and computations, Reporting of analytical data, Statistical evaluation of data.
3	**Food Analysis:** Introduction to Food Analysis, Reasons for analyzing food, Analysis of moisture of food materials, Moisture in spices and condiments, Moisture in butter and ghee, Analysis of ash, Acid insoluble ash in spices, Water insoluble ash, Analysis of crude fibers, Analysis of Fat, Determination of fructose/glucose ratio, Analysis of starch content, Microscopic examination of food, Paper chromatography, Derivatisation.
4	**Analysis of Water Pollution**: Introduction to water pollution, Effects of water pollutants, Sources of water pollution, Effects of soil pollution, Water analysis, conductivity, Alkalinity, Analysis of different forms of Nitrogen, Dissolved Oxygen, Bio chemical Oxygen demand, Separation, Detection and estimation of Herbicides.
5	**Soil Analysis:** Introduction to soil analysis, Analysis of soil, Soil pH, Determination of pH, Equipment and reagents, Total nitrogen, Silica, Salts, Soil water extract.
6	**Fuel Analysis:** Introduction to fuel analysis, Classification of fuels, Natural solid fuels, Liquid fuels, Refining of Petroleum, Gaseous fuels and their advantages, Features of the plant, Uses of natural gas, Determination of calorific value, Analysis of coal, Aniline point of liquid fuels, Flash and fire point of liquid fuels, Octane number of liquid fuels.
7	**Clinical Chemistry:** Introduction to clinical chemistry, Composition of blood, Detailed study of blood components, Collection and preservations of samples, Immunoassay, nutrition, Estimation of blood chloride, Determination of Bicarbonate, Barfoed's Test, Estimation of blood glucose, Clinical Interpretation, Trace elements in the body.
8	**Drugs Analysis:** Introduction to drug analysis, Sources of drugs, Difference between a drug and a medicine, Narcotics, Classification of drugs, Central nervous system drugs, Drug screening using gas chromatography, Drug Analysis, Antihistamines – Anti allergic agents, Analysis of cholinergic agents, Thin layer chromatography of drugs, Calorimetry and spectrophotometery, Theory of spectrophotometery and calorimetry, Wave length selection.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Analytical Chemistry:G.D. Christian, J.Wicy.

B. Fundamentals o analytical Chemistry: D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.

C. Analytical Chemistry-Principles:J.H. Kennedy. W.B. Saunders.

D. Analytical Chemistry-Principles and Techniques: LG. Hargis. Prentice Hall. Reading

GROUP THEORY AND SPECTROSCOPY – CHM16105

UNIT	CONTENTS
1	**Atomic Theories and Spectrum of Hydrogen Atom:** Introduction to Atomic Theories and Spectrum of Hydrogen Atom, Production and Types of Spectra, Absorption spectra in everyday life, Wave number, Bohr's theory and spectrum of Hydrogen atom, Energy level diagram, Motion of the nucleus, Evidences in favour of Bohr's theory.
2	**Sommerfeld Theory of Hydrogen Atom:** Introduction to Sommerfeld Theory of Hydrogen Atom, The Quantum conditions, Applications of Quantisation, Two-Dimensional Oscillator, Sommerfeld Elliptical Orbits, Fine structure of Ha Line, Selection rule for Azimuthal quantum number, Criticism and limitations of old quantum-mechanical models.
3	**Vector Atom Model and Stern:** Gerlach Experiment-Introduction to Vector Atom Model and Stern-Gerlach experiment, The spinning electron, Quantum numbers and their physical interpretation, Stern and Gerlach Experiment, Fine structure of hydrogen lines, Positronium, Masonic Atoms.
4	**Quantum Mechanical Theory of Hydrogen Atom:** Introduction to Quantum Mechanical theory of Hydrogen Atom, Principle of Wave Mechanics, Quantum mechanics of Hydrogen Atom, Interpretation of the results of Schrodinger Equation, Angular momentum, Correspondence principle for Intensities and Polarization.
5	**Pauli Exclusion Principle and Atomic Structure:** Introduction to Pauli Exclusion Principle and Atomic Structure, Maximum number of electrons in a given group or subgroup, Ground state of an atom, Multiplicity and Pauli's Principle, Periodic table, Electronic configuration.
6	**Spectra of Alkali and Alkaline Elements:** Introduction to Spectra of Alkali and Alkaline Elements, Ritz combination principle, Explanation of salient features of Alkali Spectra, Transition Rules, Alkali like Spectra, Atoms of Alkaline Elements, Spectra of Alkaline Earths, Interaction energy in L-S coupling, Term series and limits in two electron systems, Selection rules in Atoms of two valence Electrons.
7	**Spectral Lines and the Factors Affecting it:** Introduction to Spectral lines and the factors affecting it, Basic facts and SommerfledTheory, Fine structure of hydrogen lines, Quantum Mechanical treatment for fine structure, Experimental study of Hyperfine structure, Quantum mechanical treatment of Hyperfine structure, Measurement of Nuclear spin,The width of spectral lines.
8	**Complex Spectra:** Introduction to complex spectra, The wave equation for a complex atom, Terms in many electron atom, Terms in equivalent electron systems, Briet's scheme, Hund's rule, Lande Interval rule, Order of fine structure levels, Energy level diagram for complex atom, Regularities in atomic spectra of complex atoms.
9	**Effect of Magnetic and Electric Field on the Spectrum of an Atom (Zeeman Effect, Paschen-Back Effect and Stark Effect):** Introduction to Effect of Magnetic and Electric Field on the Spectrum of an Atom (Zeeman Effect, Paschen-Back Effect and Stark Effect), Experimental study of Zeeman effect, Vector model and normal Zeeman effect, Paschen-Back effect, Quantum mechanical treatment of Zeeman and Paschen Back effect, Lande's factor for two valence electron system, Few transitions of Zeeman and Paschen Back effect, Zeeman effect of hyperfine structure, Stark Effect.
10	**X-Rays and X-Ray Spectra:** Introduction to X-rays and X-ray spectra, Production of X-rays, Origin of X-radiations according to electromagnetic theory, Measurement of X-radiations, Polarisation of X-radiations, Bragg's law, Coherent scattering, Continuous X-ray spectrum, Characteristic absorption spectrum, Explanation of emission and absorption spectra, Energy levels.
11	**Molecular Binding:** Introduction to Molecular Binding, The variation method, The hydrogen molecule ION, Properties of chemical binding, Van Der Waals forces, Bohr and Oppenheimer approximation, Rotation and vibration of Diatomic Molecule.
12	**Types of Molecular Energy States and Molecular Spectra**: Introduction to types of molecular energy states and molecular spectra, Separation of electronic and nuclear motion,

	Types of molecular energy and associated spectra, Vibrational rotational bands, Pure rotational bands, Types of spectra, Regions of the spectrum, Electronic spectra.
13	**Raman Spectra:** Introduction to Raman Spectra, Raman effect and its salient features, Observation of Raman spectra, Classical theory of Raman Effect, Probability of energy Transition on Raman Effect, Pure rotational Raman spectra, Structure determination from Raman and Infra-red spectroscopy.
14	**Electronic Spectra : Franck Condon Principal (Ultraviolet and Visible Spectroscopy):** Introduction to Electronic Spectra : Franck Condon Principal (Ultraviolet and Visible Spectroscopy), Salient features of molecular electronic spectra, Formation of electronic spectra, Frank-Condon principle, Electronic spectra in emission and absorption, Vibrational coarse structure, Rotational fine structures of electronic vibrational transitions, The Fortrat Diagram.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Modern Spectroscopy:J.M. Hollas, John Viley.

B. Applied Electron Spectroscopy for chemical analysis : D. H. Windawi and F.L. Ho, Wiley Interscience.

C. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry :R.V. Parish, Ellis Harwood.

D. Physical Methods in Chemistry :R.S. Drago, Saunders College.

ENVIRONMENTAL CHEMISTRY – CHM16106

UNIT	CONTENTS
1	**Introduction To Environmental Chemistry:** Scope of the environmental Chemistry, Environmental pollution, Pollutants, Lithosphere, Hydrosphere, Biosphere, Atmosphere, Calculation of global mean temperature, Biological Cycles in the Environment.
2	**Atmosphere Air Pollution:** Composition of the atmosphere, Particles, ions and Radicals in the atmosphere, Radicals, Chemical and photochemical reactions in atmosphere, Air pollution, Formation of organic particulate matter, Radioactive pollutants, Inter dependence of human activities meteorology and air pollution.
3	**Vehicular Pollution:** Automobile Emissions, Effects of the pollutants, Dispersion of the pollutants, Effect of Hydrocarbons, Alternatives fuels, Propane as Automobile fuels, Bio fuels, Global efforts in reducing Vehicular pollution.
4	**Green House Effect and Global Warming:** Green House effect, Quantitative Green House Effect, Green House Gases, Global Warming and climate changes, Latest about global warming, Bush fire in Australia -2003, El Nino and Phenomenon, El Nino and drought, LA Nina.
5	**Ozone Layer - The Earth's Protective Umbrella:** Mechanism of Ozone formation, Mechanism of Depletion, Effects on Human beings, Effects on community, Chlorofluorocarbons, Stability of CFCS, How CFCS Attack Ozone? Safe dispersal of CFCS.
6	**Acid Rain:** Where does the acid come from, How acid rain is formed, Theory of acid rains, Formative of Sulphuric acid in atmosphere, Photo chemical oxidation of SO2, Oxidation of

	SO2 by radicals, Effects of acid rain on human beings, Effects of rain on terrestrial ecosystem, Injury to vegetation by acid rain, Effects of acid rain on buildings, Control of acid rain.
7	**Analytical Methods For Monitoring Air Pollutants:** Sampling, Sampling of gases and vapors, Sampling of particulate pollutants, Stock Sampling, Particulate Sampling by Isokinetic Technique, Continuous monitoring instruments for air pollutants, Instrumental Techniques for monitoring air pollutants, Chemiluminescence method for the automatic monitoring of ozone, Monitoring of Oxidants and ozone, Spectrophotometric determination of ozone, X-ray fluorescence.
8	**Air Pollution Control Methods:** Source correction methods, Control of particulate emission, Cyclone separators, Fabric filter system, Electrostatic precipitations, Selection of a particulate collector, Control of Gaseous pollutants, Modification of operating conditions.
9	**Hydrosphere: Water Pollution:** Water resources, Ground water, Surface water, Rain water, Stages of Hydrological water, Chemical composition of water bodies, Complexation in natural water and waste water, Microorganism in aquatic chemical reactions, Water pollution.
10	**Types And Sources Of Water Pollution:** Ground water pollution, Sources of contamination in Ground water, Cases of Ground water contamination, Arsenic contamination Ground water, Factors affecting surface water, Sources of surface water pollution, Progress aggravating pollution problems in water, River basins, The Ganga Basin, Ganga Action Plan.
11	**Water Pollutants and Their Effects:** Inorganic pollutants and toxic metals, Acids and Alkalies, Insoluble and soluble salts, Detrimental effects of inorganic pollutants, Organic pollutants, Sewage and domestic waste, Effects of synthetic detergents, Effects of pathogens, Radioactive pollutants, Eutrophication, Effects of thermal pollution on aquatic, Biological Pollutants.
12	**Treatment of Sewage and Industrial Waste Water**: Domestic sewage treatment, Strength of sewage, Primary treatment, Secondary treatment, Industrial waste water treatment, Processes employed in tertiary treatment, Commonly used biological treatment process for sewage and industrial waste water, Lagooning process, Aerobic treatment process, Activated sludge process.
13	**Control of Water Pollution:** Minimizing and controlling water pollution, Using water Hyacinth to fight water pollution, Removal of pollutants from water, Removal of salts by reverse osmosis, Removal of chlorophenols, Function of the Central Pollution Central Board, Recycling of waste water, Recycling of metals industrials wastes, Water pollution laws, Water quality parameters and standards.
14	**Analysis of Water Pollutants:** Preservation methods, Preconcentration methods, Chemical substances affecting potability, Spectrophotometric method, Differential pulse polarography for the determination of copper and zinc in tap water, Determination of oil and grease, Determination of chemical oxygen demand in waste water, Biological examination of water, Radiological examinations
15	**Lithosphere Soil Chemistry:** Radiometric methods of analysis, Nuclear activation analysis (NAA), Radiometric titration, What is soil? Soil formation, Carbonation, Biological weathering, Organic matter in soil, Micro and macro plant nutrients
16	**Soil Pollution:** Sources of Soil Pollution, Soil Pollution by Urban Wastes, Radioactive Pollutants, Metallic Pollutants, Soil Sediments as Pollutant, Detrimental Effects soil Pollutants, Effects of Urban Waste Products, Effects of Modern Agro-Technology, Effects of Sediments, Diseases Caused by Soil Pollution
17	**Soil Waste: Management, Treatment and Recycling:** Classification of Solid Waste, Objectives of Solid waste Management, Characteristics of Solid Waste, Methods of Collection of Solid Wastes, Municipal Solid waste Treatment, Automate System of Compositing, Sanitary Land Fill, Adverse effects of Land Fill.
18	**Control of Soil Pollution:** Control of Soil Pollution, Effective measures to Prevent Soil Pollution, Biofertilizers Replacing Chemical Fertilizers, Blue green Algae as biofertilizer, Natural Pesticides Replacing Synthetic Pesticides, Utilisation of Waste Products, Medicines form Agricultural Wastes, Biotechnology and Pollution Control, Phytoremediation, Biodegradability, Biodegradability of lignin.

19	**Chemical Toxicology:** Classification of Elements, Biochemical Effects of Metals, Biochemical Effects of Cadmium, Toxicology of lead, Toxicology of Tetraethyl Lead, Biochemical Effects of Arsenic, Biochemical Effects of Mercury Biological Methylation - Amplification of Hg in food chain, Treatment of Mercury Poisoning, Solutions to Environmental Problems, Preventive Environmental Management.
20	**Instrumental techniques in environmental analysis:** Non-dispersive Infra Red Spectroscopy, Fourier Transform in Infrared Spectroscopy, Principle of AAS, Absorption of Radiant Energy by Atoms, Inductively Coupled Plasma Atomic Emission Spectroscopy, Crossed-flow Nebulizer Technique, Comparison of IC PAES with. AAS, Gas chromatography, High Performance Liquid Chromatography, Application of Ion Chromatography.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Environmental Chemistry: Colin Baird, W.H. Freeman Co. New York, 1998.

B. Chemistry of Atmospheres: R.P. Wayne, Oxford.

C. Environment Chemistry:A.K. De, Wiley Eastern, 2004.

INDUSTRIAL CHEMISTRY – CHM16107

UNIT	CONTENTS
1	**Drugs and Sources of Drugs:** Disease, Classification of Disease, List of Common Diseases, Chemotherapy, Drug, Types of drugs.
2	**Sources of Drugs:** Drug from Plants, Drugs from Bacteria, Important Bacterial Drugs, Anti-Biotics, Antitumor agents, Other bioactive metabolites, Immunosuppressive agents, Enzyme inhibitors and chelating agents, Drug names.
3	**Pain Killers and Hypnotics:** Analgesics, Recommended dosage, Side effects, Natural peptide analgesics-Enkephalius, Morphine and codeine, Methadone, Anesthetics, Ether, Primary-Secondary and Tertiary Ethers, Hydrolysis, Methoxyflurane, Chloroform.
4	**Hypnotics:** Sedative-Hypnotics and Tranquilizers, Tolerance, cross tolerance, Barbiturates, Barbiturate development, Basic barbiturate pharmacology, GABAA Complex, Specific organ function effects, Respiratory effects, Benzodiazepines, tolerance.
5	**Antimalarials, Antibiotics and Antidiabetic Drugs:** Malaria, Antimalarials recommended dosage, Precautions, Use of certain medicines and their side effects, Some important anti malarials, Quinine, Properties and uses of Quinine.
6	**Antibiotics:** Antibiotics, Bacteria and disease, How do bacteria cause disease? Penicillin, Drug resistance and sensitivity, BenzathineBenzylpenicillin, Penicillin G, Penicillin V, Extended Spectrum Penicillins, Stoptomycin, Tetracycline, Polypeptide antibiotics, Actinomycin.
7	**Vitamins and Hormones:** Vitamins, Water soluble vitamins, Units of measurement, Vitamin A overdose, Vitamin B complex, Vitamin C, Cholecalciferol (D3), Clinical significance of Vitamin D deficiency, Vitamin E, Vitamin E and heart disease.
8	**Hormones:** Endocrine System, Pineal Gland, Adrenals, Endocrine Glands and the Hormones Secreted, Diffuse Endocrine System, Pituitary Gland, Thyroid Gland, Thyroxin, Pancreas, Adrenal Gland.
9	**Polymer Chemistry:** Classification of Polymers, Thermoplastics, Synthesis of addition

	Polymerization, Radical Chain growth Polymerization, Cationic chain growth polymerization, Anionic chain growth polymerization, Condensation polymers, Characteristics of condensation polymers, Polymerization of cyclic compounds or ring opening polymerization, Inorganic polymers.
10	**Polymer Structure:** Polymer morphology, Polymer structure, Configuration, Conformation lattice simulation, Cross linking, Crystallinity, XRD, Bragg's law.
11	**Chemistry of Polymerization:** Step Polymerization, Initiation, Propagation, Termination, Disproportionation, Ziegler Natta Catalyst, Plasma Polymerization.
12	**Chemistry of Polymers:** Polyethylene, History of polyethylene, Standard oil process for making polyethylene, Polystyrene, SBS rubber, Understand about varnish, History and applications of cellulose.
13	**Polymers :** Processing Techniques-Polymer processing, Compression molding, Transfer molding, Extrusion, Plastics processing techniques, Calendaring, Element winding, Melt spinning, Reaction, Spinning, True synthetic fibers, Polyolefin fiber process description.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. An Introduction to Industrial Chemistry: C A Heaton, Springer Publisher, 1996.

B. The Chemical Process Industries: Shreve, R. Norris, and Joseph A. Brink Jr, McGraw Hill, 1977.

INORGANIC CHEMISTRY-I – CHM16101P

UNIT	CONTENTS
1	Preparation of selected inorganic compounds and their study by IR, Electronic spectra, Mossbauer. ESR and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds involving vacuum lines. Selection can be made from the following: 1. Sodium amide. 2. Synthesis and thermal analysis of group II metal oxalate hydrate 3. Atomic absorption analysis of Mg and Ca. 4. Trialkoxyboanes-IR and NMR spectra. 5. PhBd2 Dichlorophenylborane - Synthesis in vacuum line. 6. Preparation of Tin (IV) iodide, Tin (IV) chloride and Tin (II) iodide. 7. Preparation of ammonium hexachlorostannate (NH4)2 SnCl6 ammonium hexachlorophlumbate (NH4)2PbCl6. 8. Hexa-bis (4, nitrophenoxy) cyclotriphosphazene. 9. Synthesis of trichlorodiphenyl antimony (V) hydrate. 10. Sodium tetrathionate Na2S4O6. 11. Metal complexes of dimethyl sulfoxide (IR) :CuCl2.2DMSO, PdCl2. 2DMSO, RuCl2. 4DMSO. 12. Synthesis of metal acethylacetonate : Magnetic moment, IR, NMR. 13. Bromination of Cr (acac)3. 14. Magnetic moment of Cu (acac) 2H2O. 15. Cis and Trns [Co (en) 2CI2] +. 16. Separation of optical isomer of cis-[Co (en) 2CI2]

	17. Ion exchange separation of oxidation state of vanadium. 18. Determination of Cr (III) complexes. [Cr(H2O)6]NO3.3HO, [Cr(H2O)4Cl2]Cl.2H2O, [Cr(en)3]Cl3, Cr(acac)3. 19. Preparation of N, N bis (salicycladehyde) ethylenedimine, salenH2. Co(Salen). 20. Preparation of Fe(II) chloride (use it as Friedel-Craft chlorination source). 21. Reaction of Cr(III) with a multidentate ligand; a kinetics experiment (visible spectra Cr-EDTA complex). 22. Preparation and use of Ferrocene. 23. Preparation of copper glycine complex-cis and transbis (glycinato Copper (II). 24. Preparation of phosphine Ph3P and its transition metal complexes. 25. Any other experimetn such as conversion of p-xylene to terephtalic acid catalyzed by CoBr2 (homogeneous catalysis). 26. Preparation of [Co (phenathroline-5, 6 quinine)].

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. A Guide Book to Mechanism in Inorganic Chemistry, Peter Sykes, Longman.

B. Structure and Mechanism in Inorganic Chemistry, C.K. Ingold, Comell University Press.

ORGANIC CHEMISTRY-I – CHM16102P

UNIT	CONTENTS
	Qualitative Analysis-Separation, Purification and Identification of the components of a mixture of Three Organic Compounds (three solids or two liquids and one solid or two solids and one liquid), Using TC for checking the purity of the separated compounds, chemical analysis, IR, PMR and mass spectral data. Multi-step Synthesis of Organic Compounds-The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques. Photochemical reaction Benzophenone>Benzopinacol>Benzopinacolone Beckmann rearrangement- Benzanilide from benzene Benzene> Benzophenone> Benzophenoneoxime > BenzanilideBenzilic acid rearrangement :Benzilic acid from benzoin Benzoin>Benzil>Benzilic acid Synthesis of heterocyclic compounds Skraup synthesis : Preparation of quinoline from aniline Fisher Indole synthesis : Preparation of 2-phenylindole from phenylhydrazine. Enzymatic synthesis Enzymatic synthesis Enzymatic reduction : reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S (+) ehtyl-3-hydroxybutanoate and determine its optical purity. Biosynthesis of ethanol from sucrose. Synthesis using microwave Alkylation of diethyl malonate with benzyl chloride. Synthesis using phase transfer catalyst. Alkylation of diethyl malonate or ethyl acetoacetate with an alkylhalide.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March,John Wiley.

B. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.

C. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.

D. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.

PHYSICAL CHEMISTRY-I – CHM16103P

UNIT	CONTENTS
	Physical chemistry-I (A) Thermodynamics:- i. Determination of partial molar volume of solute (e.g. KCl) and solvent in a binary mixture. ii. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intramolecular in reactions (benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution. (B) Spectroscopy:- i. Determination of kPa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media. ii. Determination of stoichiometry and stability constant of Ferricisothicoyanation complex ion in solution. iii. Determination of rate constant of alkaline bleaching of Malachite green and effect of ionic strength on the rate of reaction.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Quantum Chemistry: Ira N. Levine, Prentice Hall.

B. Physical Chemistry:P.W. Atkins, ELBS.

C. Introduction to Quantum Chemistry:A.K. Chandra, Tata McGraw Hill.

YEAR II

MEDICINAL CHEMISTRY – CHM16201

UNIT	CONTENTS
1	**Introduction to Drug Design-**Drug, Nomenclature of drugs, Systemic action, Adverse effects of drugs, Minimization of adverse effects, Types of adverse effects, Naming of heterocyclic Nuclei, Human Teratogenic drugs.
2	**Drug Development:** Development of new drugs, Factors affecting development of new drug, Lead compound, Lead generation/sawers and lead modification, Sources of lead compounds, Natural sources, Concept of Qsar, Molecular orbital method, Discriminate analysis, Procedure followed in drug design, Uses of soft drug principle, Drug receptors.
3	**Pharmacokinetics:** Passive Diffusion, Drug absorption, Luminal effect of drugs, Pharmacokinetic of elimination. Pharmacokinetic in drug development process by prolonging absorption from site administration increasing plasma protein binding retarding renal excretion.
4	**Pharmacodynamics:** Stimulation, Replacement, Membrane active drugs, Drug metabolism, Factors affecting drug metabolism, Significance of drug metabolism in medical chemistry, Inhibition of drug metabolism, Toxicology, Dose and dose response, Physiological autogorusm.
5	**Antineoplastic Agents:** Malignant timer, Addition of new genetic material, Changed gene expression, Radiation, Action of antineoplastic drugs, Role of Alkylating agents in treatment of cancer, Role of antimetabolism in treatment of cancer, Hormones.
6	**Cardiovascular Drugs:** Cardiac glycosides, Natural Cardiac Glycosides, Calcium channel blockers, Anti arrhythmic agents, Cardiac failure, Ischemic heart disease, Cardiac arrhythmias, Platelet aggregation.
7	**Local Anti-Infective Drug:** Anti fungal drugs, Antiamoebic drugs, General mode of action, Anti bacterial drugs,General mode of action, Anti malarial drugs, Pharmacodynamics, Chloroquine, Pyridine-u-carboxylic acid hydrarode.
8	**Psychoactive Drugs/Neuroactive Agents:** Psychoses, Affective disorders, Neuroses, Neurotransmitters, CNS depressants, Sedatives, Barbiturates, Techniques of inhalation of anaesthetics, Dissociative anesthesia, Opioid analgesia.
9	**Antibiotics:** List of some antibiotics, Cell wall biosynthesis, Chemical composition of cell wall, Biosynthesis of cell wall polysaccharide, Biosynthesis of proteins, B lactam-rings, Chemical structure of Penicillin, Streptomycin, Synthesis of penicillin h., Synthesis of ampicillin, Tetra cyclones,

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Biochemistry: D Voet and JG Voet, John Wiley& Sons.

B. Principals of medicinal chemistry: W O Foye.

NUCLEAR & RADIOCHEMISTRY – CHM16202

UNIT	CONTENTS
1	**The Atomic Nucleus:** Elementary Particles, Sub-Nucleons: The Quarks, The Nucleus and the Outer Sphere, Classification of Nuclides, Nuclear Stability, Atomic Energy.
2	**Radioactive of Nucleons and Nuclei:** The Nuclear Radius, The Shape of the Nucleus, Mechanical Effects due to Orbiting and Spinning of Nucleons, Magnetic Quantum Numbers, Total Angular Momentum of the Nucleus, The Magnetic Properties of the Nucleus, Nuclear Resonance or Recoilless, The Electric Quadrupole Moment of Nuclides, Nuclear Parity: Symmetry under Reflection.
3	**Radioactivity:** Radioactive Elements, General characteristics of Radioactive Decay, Alpha Decay, Beta Decay Nuclear excitation - Gamma Emission, Nuclear Isomerism and Isomeric Transition, Artificial Radioactivity
4	**Nuclear Reactions:** Types of Nuclear Reactions, Conservation in Nuclear Reactions, The Compound Nucleus Theory, Specific Nuclear Reactions, Production of Exotic Nuclei, Transuraniens, Photonuclear Reactions, Thermonuclear Reactions, Fusion Reactors, The origin and evolution of elements.
5	**Nuclear Fission:** The Discovery of Nuclear Fission, Fission Fragments and their Mass Distribution, Ionic Charge of Fission Fragments, Fission Cross Sections and Thresholds,Theory of Nuclear Fission.
6	**Nuclear Reactors:** The Classification of Reactors, Reactor Power, Excess Reactivity and Control, The Breeder Reactor, Nuclear Waste Management, Nature's Nuclear Reactor.
7	**Detection and Measurement of Activity:** The Electrometer, The Ionization Chamber, Electron Pulse Counters, Types of GM Counters. Pulse Development and Quenching: The True Count Rate, Scintillation Detectors, Semiconductor Detectors, Thermoluminescence Detectors, Neutron Detectors, Proton Recoil Detector.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Nuclear and Radiochemistry: Fundamentals and Applications

B. Nuclear and Radiochemistry, G. Friedlander

CHEMISTRY OF NATURAL PRODUCTS – CHM16203

UNIT	CONTENTS
1	**Biosynthesis:** Biosynthesis and biogenesis, Methods of investigation of the biosynthesis of secondary metabolites, Biosynthesis of natural products, The reactions of biosynthesis, Origin of aromatics, Biosynthesis of terpenes, Biosynthesis of steroids, Formation of alkaloids derived from phenylalanine, Biosynthesis of cinchona alkaloids, Biosynthesis of flavonoid compounds.
2	**Terpenoids and Carotenoids:**Empirical gem dialkyl rule, Classification of terpenoids,

	biogenetic isolation of terpenoids, Isolation of terpenoids, Functional nature of oxygen, Carbonyl group, Oxidative degradation of terpenoids, Number of rings, Constitution of geranial, A-terpinal, Constitution of phytol, Abietic acid.
3	**Steroids:**Dill's Hydrocarbon, Cholesterol, Structure of nucleus, Position of Hydroxyl Group and Double Bond, Nature and Position of Side Chain, Position of Two Angular Methyl Groups, Stereo Chemistry of Steroids, Bile Acids, Androsterone, Testosterone, Progesterone, Total synthesis of progesterone.
4	**Alkaloids:** Definition, Nomenclature of alkaloids, Extraction and isolation of alkaloids, Hager's test, Classification of alkaloids, Hydroxyl group, nature of nitrogen atom, Embde's degradation atom, Von Braun's degradation, Nicotine, Synthesis of Nicotine, Synthesis of quinic acid.
5	**Plant Pigments:**Flavones, Isolation, General methods of structure determination, The baker Venkataram synthesis, Structure elucidation of luteolin, flavonals, structure elucidation of vitexin, Characterization, Colour of anthocyanin, Isoflavones, Structure elucidation of butein.
6	**Porphyrins:**Constitution of Haemin, Synthesis of pyrrole derivatives, Conversion of pyrroles to dispyrylmethane, Conversion of dispyryl methane's to porphyries, Synthesis of Haemoglobin, Synthesis of chlorophyll, Synthesis of pyrrole synthesis, Knarrpyrrole.
7	**Prostaglandins:**Clinical signification, Nomenclature and classification, Occurrence, Synthesis of prostaglandins, Synthesis of PGE_{-1}, PGE_2, $PGF_{1\alpha}$ and $PGF_{2\alpha}$.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Natural Products : Chemistry and Biological Significance : J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope and J.B. Harbome, Longman, Esses.

B. Organic Chemistry : Vol. 2 1L. Finar, ELBS

C. Stereoselective Synthesis : A Practical Approach, M. Norgradi, VCH Reading

ORGANIC CHEMISTRY-II – CHM16204

UNIT	CONTENTS
1	**Free Radical Reactions:** Free Radical Reactions, Free Radical Mechanism, Free Radical Substitution Mechanism, Neighboring Group Assistance in Free Radical Reactions, Reactivity, Autoxidation, Coupling of Alkynes, Free Radical Rearrangement, Calculation of vibrational frequencies and Hookes' Law.
2	**Addition to Carbon :** Carbon Multiple Bonds-Electrophilic Addition to carbon-Carbon Double Bond, Structural orientation and regioselectivity, Addition of bromine and chlorine, Addition of chlorine, Addition of hydrogen Halides, Electrophilic addition involving Metal Cations, Addition of BH_3, Addition of Hydrogen, Hydrogenation of Alkenes.
3	**Addition to Carbon :** Hetero Multiple Bonds-Reaction of carbony1 Compounds with carbon, Aldol Reaction of aldol addition reaction, Dehydration of the aldol addition product, Crossed aldol reactions, Robinson Annulation Reaction, Stobbe condensation, Mannich Reaction, Benzoin Condensation, Nucleophilic Addition Reaction of Carbon Compounds with Grignard Reagents.
4	**Elimination Reaction:** Elimination of Alky1 Halides, Directions of Elimination, Poor Leaving Group, Stereo-chemistry of the E2reaction, E2elimination form cyclohexanes, The E1 Reaction, Dehalogenation of Vicinal Dihalides, Peterson Elimination or Peterson Reaction, Reaction in the Presence of Acid.

5	**Pericyclic Reaction:** Symmetry in Linear Conjugated Pi systems, Symmetry in Ally 1 and 2,4-pentadiene, Excited States, Types of Pericyclic Reaction, Huckel-Mobius method, Cycloaddition Reactions, FMO Method, Huckel Mobius method, 1 3 dipolar Cycloadditions, Sigmatropic Rearrangement.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Advanced Organic Chemistry-Reactions, Mechanism and Structure : Jerry March,John Wiley.

B. Advanced Organic Chemistry: F.A. Carey and R.J. Sunderg, Plenum.

C. A Guide Book to Mechanism in Organic Chemistry: Peter Sykes, Longman.

D. Structure and Mechanism in Organic Chemistry: C.K. Ingold, Comell University

ANALYTICAL CHEMISTRY-II – CHM16205

UNIT	CONTENTS
1	**Introduction to Analytical Chemistry:** Introduction to Analytical Chemistry, Classification of Analytical Method, Difference between classical and instrumental methods, Classifying analytical techniques, Numerical criteria for selecting analytical methods, Sensitivity, Making the final choice, Filtration, Analytical balance, Calibration of glassware, Sample preparation, Application of microwave decomposition..
2	**Errors and Evaluation:** Introduction to errors and evaluation, Central value or average value, Arithmetic mean of grouped data, Median of an ungrouped data, Relative standard deviation, Determination of accuracy, Types of errors, Variations within determinate errors, Reporting of analytical data, Statistical evaluation of data, The uses of statistics.
3	**Radiochemical Methods:** Introduction to Radiochemical Methods, Radiation, Types of Radioactive Decay, Measurement of Radioactivity, Autoradiography, Types of Photographic Detection System, Preparation of Autoradiography Method, Isotopes, Advantages of Radio Tracer Techniques, Nuclear methods, NAA process, Neutrons, Instrumental Vs. Radiochemical NAA, Radio metric Titrations.
4	**Thermal Methods of Analysis:** Introduction to Thermal Methods of Analysis, Different of Radiometric Titrations, Instrument and Balances, Recording of Results, Factors affecting Thermogram, Applications of Thermogravimetry, Differential Scanning Calorimetry (DSC), Factors affecting DSC curves.
5	**Chromatographic Techniques:** Introduction to Chromatographic Techniques, Some definitions of Chromatography, Paper Chromatography, Migration Parameters, Experimental details, Column and Thin-layer Liquid Chromatography, Equipment for HPLC, Derivatisation, Quantitative analysis, High Performance Thin Layer Chromatography (HPTLC), Gas Chromatography, Affinity chromatography, Types of affinity chromatography, ION-exchange chromatography.
6	**Electro-analytical Techniques:** Introduction to electro analytical techniques, Three electron system, Electrochemical cell, Rotated electrode, Voltammetry, Applications of Voltammetry, Trace determination of metal IONs and biologically important compound by stripping technique, Polarography, Migration current, Advantages and disadvantage of dropping mercury Electrode, Types of Polarographic cells.
7	**Spectroscopic Methods of Chemical Analysis and Flame Photometry:** Introduction to spectroscopic methods of chemical analysis and flame photometry, Radiation Source, Premixed Burner, Monochromators, Detectors, Amplifier, Operation of instrument, Application of atomic absorption spectroscopy.

8	**Flame Photometry:** Introduction to Flame Photometry, Total Consumption Burner, Monochromators, Internal Standard Flame Photometer, Advantages over Modified Flame Photometer, Limitations of Flame Photometry, Qualitative analysis, Interference in flame photometry, Spectral interference.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Analytical Chemistry, G.D. Christian, J.Wicy.

B. Fundamentals o analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.

C. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.

D. Analytical Chemistry-Principles and Techniques. LG. Hargis. Prentice Hall.

INORGANIC CHEMISTRY-II-CHM16206

UNIT	CONTENTS
1	**Reaction Mechanism of Transition Metal Complexes:** Energy profile of a reaction, Reactivity of metal complex, Inert and labile complexes, Kinetic application of valence bond and crystal field theories, Kinetics of octahedral substitution, Acid hydrolysis, Factors affecting acid hydrolysis, Base hydrolysis, Conjugate base mechanism, Direct and Indirect evidences in favour of conjugate mechanism, Reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, The trans effect, Mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.
2	**Metal-Ligand bonding:** Limitation of crystal field theory, Molecular orbital theory, Octahedral, Tetrahedral and square planar complexes, p-bonding and molecular orbital theory.
3	**Electronic Spectra and Magnetic Properties of Transition Metal Complexes**: Spectroscopic Ground States, Correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d1-d9 states), Calculations of da, B and b parameters, Charge transfer spectra, Spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information, Anomalous magnetic moments, Magnetic exchange coupling and spin crossover.
4	**Metal Ions in Biological Systems:** Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K+/Na+ pump.
5	**Bioenergetics and ATP Cycle:** DNA Polymerisation, glucose storage, metal complexes in transmission of energy; Chlorophyll's, Photosystem I and Photosystem II in cleavage of water.
6	**Transport and Storage of Dioxygen**: Heme proteins and oxygen uptake structure and function of haemoglobin's, Mygolobin, Haemocyanms and hemerythrin, Model syntheticcomplexes of iron, Cobalt and Copper.
7	**Electron Transfer in Biology:** Structure and Function of Metal of Proteins in Electron Transport processes Cytochrome's and Ion-sulphureProteins, Synthetic models.
8	**Vibrational Spectroscopy:** Symmetry and shapes of AB2, AB3, AB4, AB5 and AB6, Mode of bonding of AmbidentateLigands, Ethylenediamine and Diketonato complexes, Application of resonance Raman spectroscopy particularly for the study of active sites of Metalloproteins.
9	**Electron Spin Resonance Spectroscopy:** Hyperfine coupling, Spin polarization for Atoms

	and Transition Metal Ions, Spin-orbit Coupling and Significance of G-tensors, Application to Transition metal Complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as PH4, F2 and (BH3).
10	**Nuclear Magnetic Resonance of Paramagnetic Substances in Solution:** The Contact and Pseudo Contact Shifts, Factors affecting Nuclear Relaxation, Applications including Biochemical Systems, An overview of NMR of Metal Nuclide with Emphasis on 195Pt and 119 SNNMR.
11	**Mossbauer Spectroscopy:** Basic Principles, Spectral parameters and spectrum display. Application of the technique to the studies of Bonding and structures of Fe+2 and Fe+3 compounds including those of intermediate spin, Sn+2SN=4 compounds nature of M-L bond, coordination number, structure and Detection of oxidation state and in equivalent MB atoms.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Principles of Bioinogranic Chemistry:S.J. Lippard and J.M. Berg, University Science Books.

B. Bioinorganic Chemistry, 1:Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.

C. Inorganic biochemistry:Vol. I and II ed. G.L. Eichhorn, Elsever.

D. Progress in Inorganic Chemistry:Vol 18 and 38 edJ.J. Lippard, Wiley.

PHYSICAL CHEMISTRY-II-CHM16207

UNIT	CONTENTS
1	**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 System viz., Particle in a box, The harmonic Oscillator, The Rigid Rotor, The Hydrogen Atom.
2	**Approximate Methods:** The variation theorem, Linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.
3	**Molecular Orbital Theory:** Huckel theory of conjugated systems bond and charge density calculations. Applications to ethylene, Butadiene, Cyclopropenyl Radical Cyclobutadiene etc., Introduction to extended Huckel theory.
4	**Classical Thermodynamics:** Brief resume of concepts of laws of thermodynamics, Free energy, Chemical potential and entropies. Partial molar free energy, Partial molar volume and partial molar heat content and their significance. Determinations of these quantities, Concept of fugacity and determination of fugacity, Non-ideal systems : Excess functions for non-ideal solutions, Activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transitions.
5	**Statistical Thermodynamics:** Concept of distribution, Thermodynamic probability and most probable distribution. Ensemble averaging, Postulates of Ensemble Averaging, Canonical, grand canonical and microcanonical ensembles, Corresponding distribution laws (using Lagrange's method of undetermined multipliers), Partition functions-translation, Rotational, Vibrational and Electronic Partition Functions, Calculation of Thermodynamic

	properties in terms of partition, Application of partition functions, Heat capacity behaviour of solids-chemical, Equilibria and Equilibrium constant in terms of partition functions, Fermi-Dirac Statistics, Distribution law and applications to metal, Bose-Einstein statistics distribution, Law and application to helium.
6	**Non Equilibrium Thermodynamics:** Thermodynamic criteria for non-equilibrium states, Entropy production and Entropy flow, Entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.),Transformations of the generalized fluxes and forces, Non Equilibrium stationary states, Phenomenological Equations, Microscopic reversibility and Onsager's reciprocity relations, Electrokinetic phenomena, Diffusion, Electric conduction.
7	**Chemical Dynamics:** Methods of determining rate laws, Collision theory of reaction rates, Steric factor, Activated complex theory, Arrhenius equation and the activated complex theory; Ionic reactions, Kinetic salt effects, Steady state kinetics, Kinetic and Thermodynamic control of reactions, Treatment of unimolecular reactions, Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), Photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and Homogenous catalysis, Kinetics of enzyme reactions, General features of fast reactions, Study of fast reactions by flow method, Relaxation method, Flash phototlysis and the nuclear magnetic resonance method, Dynamics of unimolecular reactions (Lindemann Hinshelwood and Rice-Ramsperger-Kassel-Marcus (RRKM) theories founimolecular reactions).
8	**Micelles:** Surface active agents, 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, Solublization, Micro emulsion, Reverse micelles.
9	**Macromolecules:** Polymer-definition, Types of polymers, Electrically conducting, Fire resistant, Liquid crystal polymers, Kinetics of polymerization, Mechanism of polymerization, Molecular mass, Number and mass average, Molecular mass determination (Osmometry, Viscometry, Diffusion and light scattering methods), Sedimentation, Chain configuration of Macromolecules, Calculation of average dimension of various chain structures.
10	**Electrochemistry:** Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, Ion solvent interactions, Thermodynamics of electrified interface equations, Derivation of electro capillarity, Lippmann equations (surface excess), Guoy-Chapman, Stem, Graham-Devanathan-Mott watts, Tobin, Bockris, Devanathan models, Over potentials, Exchange current density, Derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, Tunneling, Semiconductor interfaces-Theory of double layer at semiconductor, Electrolyte solution interfaces, Structure of double layer interfaces.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Physical Chemistry: P.W. Atkins, ELBS.

B. Introduction to Quantum Chemistyry : A.K. Chandra, Tata McGraw Hill.

C. Quantum Chemistry : Ira N. Levine, Prentice Hall.

D. Coulson's Valence: R.McWeenY, ELBS.

ORGANIC CHEMISTRY-II-CHM16204P

UNIT	CONTENTS
1	Extraction of Organic Compounds from Natural Sources:- 1. Isolation of caffeine from tea leaves. 2. Isolation of casein from milk (the students are required to try some typical colour reactions of proteins). 3. Isolation of lactose from milk (purity of sugar should be checked by LC and PC and Rf values reported). 4. Isolation of nicotine di-picrate from tobacco. 5. Isolation of cinchonine from cinchona bark. 6. Isolation of piperine from black pepper. 7. Isolation of lycopene from tomatoes. 8. Isolation of b-carotene from carrots. 9. Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of linoleic acid). 10. Isolation of eugenol from clove. 11. Isolation of (+) limonine from citrus rind. Paper Chromatography-Separation of identification of the sugars present in the given mixture of glucose, fructose and surcrose by paper chromatography and determination of Rf values. Spectroscopy- Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR& MS) Spectrophotometric (UV/VIS) Estimations 1. Amino acids 2. Proteins 3. Carbohydrates 4. Cholesterol 5. Ascorbic acid 6. Aspirin 7. Caffeine

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Organic chemistry: J. Derek Woolings, VCH.

B. Organic chemistry: Z. Szafran, R.M, Pike and M.M. Singh, Wiley.

C. Practical Organic chemistry: G. Marr and B. W. Rockett, Van Nostrad.

ANALYTICAL CHEMISTRY-II- CHM16205P

UNIT	CONTENTS
1	Flame Photometric Determinations:- a. Sodium and potassium when present together. b. Lithium/calcium/barium/strontium. c. Cadmium and magnesium in tap water. Chromatographic Separations:- a. Cadmium and zinc

	b. Zinc and magnesium. c. Thin-layer chromatography-separation of nickel, manganeses, cobalt and zinc. Determination of Rf values. d. Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of Rf values.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Analytical chemistry:J. Derek Woolings, VCH.

B. Analytical chemistry: Z. Szafran, R.M, Pike and M.M. Singh, Wiley.

C. Practical Analytical chemistry: G. Marr and B. W. Rockett, Van Nostrad.

INORGANIC CHEMISTRY-II- CHM16206P

UNIT	CONTENTS
1	Spectrophotometric Determinations:- a. Manganese/Chromium/Vanadium in steel sample. b. Nickel/molybdenum/Tungsten/Vanadium/Uraniumby extractive spectro-photometric method. c. Fluoride/nitrite/phosphate. d. Zirconium-alizarin Red-S complex: Mole-ratio method. e. Copper-Ethylene diamine complex: Slope-ratio method. f. Iron-phenanthroline complex: Job's method of continuous variations. Quantitative determinations of a three component mixture:- One Volumetrically and two gravimetrically a. Cu+2, Ni+2, Zn+2 b. Cu+2, Ni+2, Ng+2

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Inorganic Experiments: J. Derek Woolings, VCH.

B. Microscale Inorganic Chemistry: Z. Szafran, R.M, Pike and M.M. Singh, Wiley.

C. Practical Inorganic Chemistry: G. Marr and B. W. Rockett, Van Nostrad.

PHYSICAL CHEMISTRY-II - CHM16207P

UNIT	CONTENTS
1	(A) Polarography:- i. Identification and estimation of metal ions such as Cd+2, Pb+2, Zn+2, and Ni+2 etc. polarographically. ii. Study of a metal ligand complex polarographically (using Lingane's Method). (B) Chemical Kinetics:- i. Determination of rate constant and formation constant of an intermediate complex in the reaction of Ce(IV) and Hypophosphorous acid at ambient temperature. ii. Determination of energy and enthalpy of activation in the reaction of KMnO4 and benzyl alcohol in acid medium. iii. Determination of energy of activation of and entropy of activation from a single kinetic run. iv. Kinetics of an enzyme catalyzed reaction.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

A. Physical chemistry Experiments: J. Derek Woolings, VCH.

B. MicroscalePhysical chemistry: Z. Szafran, R.M, Pike and M.M. Singh, Wiley.

C. Practical Physical chemistry: G. Marr and B. W. Rockett, Van Nostrad.

D. The systematic Identification of Physical chemistry:R.L. Shriner and D.Y. Curlin.