w.e.f: July 2018

DR. C.V.RAMAN UNIVERSITY

KARGI ROAD, KOTA, BILASPUR (C.G.)

MASTER OF SCIENCE (CHEMISTRY)

Duration - 24 Months (2 Years) Eligibility - Graduation with Science Subject

SCHEME OF EXAMINATION

Course Code	Nature of the Course	Name of the Course	Credit				Total Marks	Theory		Practical Marks		Assignment	
			L	P	T	Total		Max	Min	Max	Min	Max	Min
First Semester													
4010111101	Core	Inorganic Chemistry.-I	3	-	1	4	100	70	28	-	-	30	15
4010111102	Core	Organic Chemistry.-I	3	-	1	4	100	70	28	-	-	30	15
4010111103	Core	Physical Chemistry-I	3	-	1	4	100	70	28	-	-	30	15
4010111104	Core	Analytical Chemistry-I	3	-	1	4	100	70	28	-	-	30	15
4010121101	Core	Lab-I Inorganic chemistry	-	2	-	2	100	-	-	100	50	-	-
4010121102	Core	Lab-II Physical Chemistry	-	2	-	2	100	-	-	100	50	-	-
Total			**12**	**4**	**4**	**20**	**600**	**280**	**112**	**200**	**100**	**120**	**60**
Second Semester													
4010211101	Core	Inorganic Chemistry - II	3	-	1	4	100	70	28	-	-	30	15
4010211102	Core	Organic Chemistry.-II	3	-	1	4	100	70	28	-	-	30	15
4010211103	Core	Physical Chemistry-II	3	-	1	4	100	70	28	-	-	30	15
4010211104	Core	Analytical Chemistry-II	3	-	1	4	100	70	28	-	-	30	15
4010221101	Core	Lab-I Organic Chemistry	-	2	-	2	100	-	-	100	50	-	-
4010221102	Core	Lab-II Analytical Chemistry	-	2	-	2	100	-	-	100	50	-	-
Total			**12**	**4**	**4**	**20**	**600**	**280**	**112**	**200**	**100**	**120**	**60**
Third Semester													
4010311101	Core	Application of Spectroscopy	3	-	1	4	100	70	28	-	-	30	15
4010311102	Core	Bio-organic , Bio-inorganic & Environmental Chemistry	3	-	1	4	100	70	28	-	-	30	15
	Discipline Specific Elective	Elective-I	3	-	1	4	100	70	28	-	-	30	15
	Discipline Specific Elective	Elective-II	3	-	1	4	100	70	28	-	-	30	15
4010321101	Core	Lab General -I	-	2	-	2	100	-	-	100	50	-	-
	Discipline Specific Elective	Lab Special (Elective)	-	2	-	2	100	-	-	100	50	-	-
Total			**12**	**4**	**4**	**20**	**600**	**280**	**112**	**200**	**100**	**120**	**60**
Fourth Semester													
	Discipline Specific Elective	Elective-III	3	-	1	4	100	70	28	-	-	30	15
	Discipline Specific Elective	Elective-IV	3	-	1	4	100	70	28	-	-	30	15
4010411102	Core	Lab General -II	-	2	-	2	100	-	-	100	50	-	-
4010431101	Research Component	Project Work	-	10	-	10	300	-	-	300	150	-	-
Total			**6**	**12**	**2**	**20**	**600**	**140**	**56**	**400**	**200**	**60**	**30**

Evaluation Scheme

- The minimum Marks required to pass any theory paper in a Semester shall be 40 %.
- The minimum Marks required to pass in each Project works/ Practical/ Assignments/Dissertation shall be 50%.

LIST OF ELECTIVES

***Note** - Students need to select two paper from each elective for third & fourth semester.

Elective Paper Third Semester				Elective Paper Fourth Semester			
Codes	**Nature of the Course**	**List of Electives**	**Specialization Group**	**Codes**	**Nature of the Course**	**List of Electives**	**Specialization Group**
Elective -I				**Elective -III**			
4010311103	Discipline Specific	Applied Organic Chemistry	Organic Chemistry (G-I)	4010411103	Discipline Specific	Chemistry of Natural Products	Organic Chemistry (G-I)
4010311105	Discipline Specific	Chemistry of Inorganic Materials	Inorganic Chemistry (G-II)	4010411105	Discipline Specific	Separation Science	Inorganic Chemistry (G-II)
4010311107	Discipline Specific	Advanced Chemical Kinetics	Physical Chemistry (G-III)	4010411107	Discipline Specific	Surface chemistry	Physical Chemistry (G-III)
Elective -II				**Elective -IV**			
4010311104	Discipline Specific	Drug and Heterocyclic compound	Organic Chemistry (G-I)	4010411104	Discipline Specific	Stereo Chemistry	Organic Chemistry (G-I)
4010311106	Discipline Specific	Co-ordination Chemistry	Inorganic Chemistry (G-II)	4010411106	Discipline Specific	Organometalic Chemistry	Inorganic Chemistry (G-II)
4010311108	Discipline Specific	Electro Chemistry	Physical Chemistry (G-III)	4010411108	Discipline Specific	Chemistry of Materials	Physical Chemistry (G-III)

LIST OF ELECTIVE LAB SPECIAL THIRD SEMESTER

4010321102	Lab Special Elective	Organic Chemistry (G-I)
4010321103	Lab Special Elective	Inorganic Chemistry (G-II)
4010321104	Lab Special Elective	Physical Chemistry (G-III)

Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 1st **Subject Code: 4010111101**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: INORGANIC CHEMISTRY.-I **Theory Min. Marks: 28**

Course objective- To understand wave mechanics, drawbacks of VSEPR theory with explanation, about transition elements, properties and role of elements in biological process and symmetry elements

UNIT-I

Wave mechanics : Origin of quantum theory, black body radiation, atomic spectra, photoelectric effect, matter waves, wave nature of the electron, the wave equation, the theory of hydrogen atom, particle in one dimensional box, transformation of coordinates, Separation of variables and their significance.

UNIT-II

Stereochemistry and Bonding in main group: VSEPR theory &drawbacks, Walsh diagram (tri and penta atomic molecules dπ-pπ bonds, Bent rule, and energetic of hybridization, some simple reactions of covalently bonded molecules.

Unit-III

Chemistry of transition elements: General characteristic properties of transition elements, co-ordination chemistry of transition metal ions, stereochemistry of coordination compounds, ligand field Theory, splitting of d orbital's in low symmetry environments, John- Teller effect, Interpretation of electronic spectra including charge transfer spectra, Spectrochemical series, nephelauxetic series, metal clusters, sandwich compounds, metal carbonyls.

Unit-IV

Bioinorganic Chemistry : Role of metal ions in biological processes, structure and properties of metalloproteinase in electron transport processes, cytochromes, ferrodoxins and iornsulphur proteins, ion transport across membranes, Biological nitrogen fixation, PSI ,PS – II, Oxygen uptake proteins.

UNIT-V

Symmetry and group theory in chemistry: Symmetry elements and symmetry operations, definition of group and and sub group, relation between order of finite group and its sub group. Congugacy relation and classes, point symmetry group, (representation for Cn, Cnv, Cnh, Dnh etc. Groups to be worked out explicitly).Character of representation.

Course outcomes-

After the completion of course learner should able to understand about

- Classical wave mechanics, derivations related to wave mechanics.
- Distorted symmetry of molecules with different explanations.
- Characteristics of d-block elements and co-ordination chemistry.
- bio-inorganic chemistry
- symmetry elements and explanation of group theory

Text book:

- J H, Huheey, Inorganic Chemistry – Principal, structure and reactivity, Hrper And Row Publisher, Inc. York (1992)
- J.D. Lee, Concise Inorganic Chemistry, Elba with Chapman and Hall, London
- F.A. Cotton, R.G. Wilkinson. Advanced Inorganic chemistry
- Chakrabury,Sold State Chemistry, New Age International Science e Books
- Inorganic chemistry vol 1&2 Gurdeep Raj, Goal publication.
- Inorganic chemistry- R. Sarkar (Vol.I-II), Newcentraj Book Agency.
- Basic Principales of Inorganic chemistry- Asim Kr. Das (Vol. I-II), CBS publishers,s Distributors, New Delhi.

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SEMESTER- 1st **Subject Code: 4010111102**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: ORGANIC CHEMISTRY.-I **Theory Min. Marks: 28**

COURSE OBJECTIVES: The aim of this organic chemistry course is to introduce the key concepts of organic chemistry through the basic reactions Particular emphasis is placed on the underlying mechanistic pathways that are involved together with some of their stereochemical consequences. Hence, the course seeks to establish a sound foundation on which further learning in organic chemistry can built.

UNIT-I

Reaction Mechanism: Structure and Reactivity : Types of reactions, potential energy diagrams, transition states and intermediates.Hard and soft acids and bases, strength of acids and bases. Generation, structure,stability and reactivity of carbocations and carbanions.

b) Aliphatic Nucleophilic substitutions: The SN2, SN1 reactions with respects to mechanism and stereochemistry.Reactivity effect of substrate structure, effect of attacking nucleophiles, leaving groups and reaction medium, Neighbouring Group Participation. Nucleophilic aromatic substitutionreactions SN1, SN2.

UNIT-II

Aromatic Electrophilic Substitutions: Introduction, Concept of Aromaticity, the arenium ion mechanism, orientation and reactivity in Nitration, Sulphonation, Friedel-Crafts and Halogenation in aromatic systems, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in their ring systems.Diazo-coupling, Vilsmeir reaction, Gatterman-Koch rection, Von Richter rearrangement .

UNIT-III

Addition to Carbon–Carbon Multiple Bonds : Mechanism and steriochemical aspects of the addition reactions involving electrophiles and free radicals, regio and chemo-selectivity, orientation and reactivity. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings.Michael reaction.

UNIT-IV

Elimination Reactions: The E1, E2 and E1cB mechanisms. Orientation in Elimination reactions. Reactivity: effects of substrate structures, attacking base the leaving group the nature of medium on elimination reactions. Pyrolytic elimination reactions.

UNIT-V

Study of following reactions: Beckman, Fries, Benzilic acid, Hoffman, Schmidt, Curtius, Lossen&Benzilic acid, **Stereochemistry:** Concept of Chirality and molecular dissymmetry, Recognition of symmetry elements and chiral centers, Prochiral relationship, homotopic, enantiotopic and disteriotopic groups and faces. Recemic modifications and their resolution, R and S nomenclature.Geometrical isomerism E and Z. Nomenclature. Conformational analysis : cyclohexane derivatives, stability and reactivity,

Course Outcomes: Students will gain an understanding of the prediction of mechanisms for organic reactions, understanding of organic mechanisms to predict the outcome of reactions, the reactivity and stability of an organic molecule based on structure, including conformation and stereochemistry.

Text book:

- Mechanism and structure in Organic chemistry (Holt Reinh.) B.S. Gould.
- Organic reaction mechanism (McGraw-Hill) R.K. Bansal.
- Reaction mechanism in organic chemistry- S.M. Mukharji and S.P. Singh
- Stereochemistry by P.S. Kalsi (New Age International)
- Reaction and Reagent O.P. Agrawal
- Organic chemistry – Jagdamba Singh Pragati Publication.
- Reaction mechanism inorganic chemistry, Mukharkee, Kaopoor., New Age International.

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SEMESTER- 1st **Subject Code: 4010111103**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: PHYSICAL CHEMISTRY-I **Theory Min. Marks: 28**

Course objective-

To understand basic concept of thermodynamics, kinetic theory of gases, colloids and macromolecules and phase rule.

UNIT- I

THERMODYNAMICS-I Introduction, revision of basic concepts.Second law of thermodynamics: Physical significance of entropy (Direction of spontaneous change and dispersal of energy), Carnot cycle, efficiency of heat engine, coefficient of performance of heat engine, refrigeration and problems. Maxwell relations, thermodynamic equation of state, chemical potential, variation of chemical potential with temperature & pressure.Applications of chemical potential, phase rule, lowering of vapor pressure (Rault's law) and elevation in boiling point.

UNIT-II

THERMODYNAMICS-II : Ideal solutions, Rault's law, Duhem-Margules equation and its applications to vaporpressure curves(Binary liquid mixture), determination of activity coefficients fromvapor pressure measurements, Henry's law. Nonidealsolutions : deviations from ideal behaviour of liquid mixtures, liquidvapor compositions, conditions for maximum.

UNIT-III

KINETIC THEORY OF GASSES : Postulates of kinetic theory of gases, P-V-T relations for an ideal gas, non-idealbehavior of gases, equation of state, compressibility factor, virial equation, van derWaal's equation, excluded volume and molecular diameter, relations of van derWaal's constants with virial coefficients and Boyle temperature. Molecular statistics, distribution of molecular states, deviations of Boltzmannlaw for molecular distribution, translational partition function, Maxwell-Boltzmann law for distribution of molecular velocities, physical significance of the distribution law, deviation of expressions for average, root mean square and most probable velocities, experimental verification of the distribution law. Molecular collision in gases, mean free path, collision diameter and collision number in a gas and in a mixture of gases, kinetic theory of viscosity and diffusion.

UNIT-IV

COLLOIDS AND MACROMOLECULES: Sols, Lyophilic and lyophobic sols, properties of sols, coagulation. Sols of surface active reagents, surface tension and surfactants, critical micelle concentration. Macromolecules: Mechanism of polymerization, molecular weight of a polymer (Number and mass average) viscosity average molecular weight, numerical problems. Degree of polymerization and molecular weight, methods of determining molecular weights(Osmometry, viscometry, light scattering, diffusion and ultracentrifugation) Chemistry of polymerization: Free radical polymerization(Initiation, propagation and termination), kinetics of free radical polymerization, step growth polymerization(Polycondensation), kinetics of step polymerization, cationic and anionic polymerization.(More stress should be given to solving numerical problems)

UNIT-V

Phase ruleDistribution Law: Partition of iodine between water and carbon tetrachloride. Equilibrium constant of I- + I2 □ I3-.Concentration of unknown potassium iodide.Partition of ammonia between water and chloroform.Partition of aniline between benzene and water.Hydrolysis constant of aniline hydrochloride.Association of benzoic acid in Naphthalene. Solid-Liquid Equlibria: Construction of phase diagrams of simple eutectics, systems with congruent melting points and solid solutions. Determination of composition of unknown mixtures.Analytical and synthetic methods for the determination of solubilities.

Course outcomes-

After the completion of course learner should able to understand the following:

- Knowledge about Thermodynamics first and second law.
- Knowledge about Kinetic theory of gases and statistical thermodynamics.
- Knowledge about colloids and macromolecules.
- Knowledge about phase rule and distribution law.

Text book:

- Text book of Physical Chemistry- S. Glasstone
- Physical Chemistry- G.M. Barrow, Tata-McGraw Hill, Vth edition, 2003
- Physical Chemistry- G.K. Vemulapalli, Prentice-Hall of India, 1997.
- A Text book of Physical Chemistry- A.S. Negi- New Age International
- A Text book of Physical Chemistry- K.L. Kaboor (Vol.I- IV) Mecmillan India Limited.
- Advanced Physical Chemistry- J.N. Gurtu R A Gurta, PragatiPrakashan.
- Advanced Physical Chemistry – Gurdeep Raj Krishran Publication.
- Physical Chemistry- Puri, Sharma &Parhalia, Vikash Publication.

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SEMESTER- 1st **Subject Code: 4010111104**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: ANALYTICAL CHEMISTRY-I **Theory Min. Marks: 28**

Course Objective:
Study of instrumental analysis in qualitative and quantitative way and the knowledge of data interpretation by modern technique.

UNIT-I

Errors and treatment of Analytical Chemistry: Errors, Determinant, constant and indeterminate. Accuracy and precision Distribution of random errors. Average derivation and standard derivation, variance and confidance limit. Significance figures and computation rules. Least square method. Methods of sampling: samples size. Techniques of sampling of gases, fluid, solids, and particulates.

UNIT-II

Chromatographic methods: (10+2): General principle, classification of chromatographic methods. Nature of partition forces. Chromatographic behavior of solutes. Column efficiency and resolution.

Gas Chromatography: detector, optimization of experimental conditions. Ion exchanges chromatography. Thin layer chromatography: coating of materials, prepative TLC. Solvents used and methods of detection Column chromatography. Adsorption and partition methods. Nature of column materials. Preparation of the column. Solvent systems and detection methods.

UNIT-III

Electroanalytical Techniques: Polarography: Introduction, Instrumentation, Ilkovic equation and its verification. Derivation of wave equation, Determination of half wave potential, qualitative and quantitative applications. Amperometry: Basic principles, instrumentation, nature of titration curves, and analytical applications.

UNIT-IV

Theory of Volumetric and Gravimetric Analysis: Standard solutions Indicators, theory of indicators , types of titrations, Acid , base , precipitation, Redox and complexometric titrations, Acid–base titrations in nonaqueous media , solvent characterisation , living effect , applications of non –aqueous titrations , MnO_2 in pyrolusite, Na_2CO_3 + $NaHCO_3$ and NaOH + Na_2CO_3 Mixture analysis , Gravimetric Analysis purity of the precipitate – Co precipitation's and post precipitations from homogenous solution , organic precipitation

UNIT-V

Computer Science: Introduction: History etc. Hardware: Central processor unit. Input devices. Storage devices.Periferals, Software: Overview of the key elements of basic program structure, loops, arrays, mathematical function. User defined functions, conditional statements, string. Applications. Data representation, Computerized instruments system. Microcomputer interfacing.

Course Outcome:

- To understand the various statistical analysis
- Knowledge of various chromatographic analysis and electro-analytical techniques
- Knowledge of volumetric and gravimetric analysis

Text book:

- Analytical Chemistry : (J.W) G.D. Christain
- Instrumental Methods of analysis (CBS)- H.H. Willard, L.L. Mirrit, J.A. Dean
- Instrumental Methods of Analysis : Chatwal and Anand
- Instrumental Methods of Inorganic Analysis (ELBS) : A.I. Vogel

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 1st **Subject Code: 4010121101**
Course: M.Sc. Chemistry **Theory Max. Marks: 100**
SUBJECT: Lab-I Inorganic chemistry **Theory Min. Marks: 50**

Course Objective:
To analyze the preparation, properties of inorganic compound. Estimation of inorganic salts mixture containing interfering radicals

Qualitative analysis of mixture containing.
Eight radical including some less common metal ions among the following by common method (preferably semi-micro method)
Basic radicals :- Ag, Pb, Hg, Cu, Cd,Bi, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, NH4, Ce, Th, Zr, w, Te, Ti, Mo, O, V, Be, Li, Au, Pt,
Acid Radicals: - Co3, SO4, SO3, NO3, F, Cl, Br, I, NO2, BO3, C2O4, PO4, SiO4, Thiosulphate, Ferroeynide, Ferricyanide, Chromate, Arsenite, Arsenate, Permanganate,

Quantitative Analysis :-
Involving two of the following in ores, alloys or mixture in solution – one by volumetric and other by gravimetric method Ag, Cu, Fe, Cr, Mn, Ni, Zn, Ba, Ca, Mg, chloride, Sulphate.

Estimation of :-
Phosphoric acid in commercial orthophosphoric acid,
Boric acid in borax,
Ammonium lon in Ammonium salt,
MnO2 in pyrolusite
Available chlorine in bleaching powder,
H2O2 in commercial sample,

Preparation of selected Inorganic compounds and study of their properties by various method including IR, Electronic Spectra, Mossbaur, ESR, Spectra magnetic susceptibility etc.
Vo(acac)2
Cis& Trans K [Cr (C2O4)2(H2O)2]. 2H2O
Na[cr(NH3)2(SCN)4]
Mn (acac)
K3[Fe(C2O4)3]
Prussian BlueTurnbulls Blue
[Co(NH3)6][Co(NO2)6]
Hg [Co (SCN)4]
[Ni (NH3)4] Cl2
Ni (DMG)2
[Cu(NH3)4]SO4
Mohr's salt
Nickel ammonium Sulphate

Course Outcomes :
- Estimation of various ions by qualitative methods.
- Preparation of some inorganic complex compounds

Reeferences

- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- The analysis of minerals and ores of the rarer elements-W.R.Schoeller and A.R.Powell, Charles, Griffin and company Ltd.

Practical Inorganic Chemistry, Gurdeep Raj, Goal Publication.

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SEMESTER- 1st **Subject Code: 4010121102**
Course: M.Sc. Chemistry **Theory Max. Marks: 100**
SUBJECT: Lab-II Physical Chemistry **Theory Min. Marks: 50**

Course Objective:
To study about adsorption, chemical kinetics, conductometry, Polarimetry and colorimetry

Asorption:-
Verification of Freundlich's Adsorption Isotherm,
Chemical Kinetics:
Determination of effect of –
Change of temperature
Change of concentrations of reactants and catalyst.
Lonic strength of the media on the velocity constant of hydrolysis of ester.
Determination of order of reaction for reaction between $K_2S_2O_8$ and KI.
Electrochemistry –
Conductometry
Determination of solubility of sparingly soluble salt (e.g., $PbSO_4$, $BaSO_4$) conductometrically.
Determination of the strength of strong and weak acids in a given mixture conductometrically.
Determination of dissociation constant of weak electrolyte by conductometer.
pHmetry/Potentiometry
Determination of the strength of strong and weak acid in a given mixture using pH meter/potentiometer.
Determination of dissociation constant of weak acid by pH meter.
Determination of concentration of acid in given buffer solution by pH meter.
Polarimetry:-
Determination of rate constant for hydrolysis/inversion of sugar using polarimeter
Solubility and partition coefficient
Effect of temperature on solubility of electrolyte.
Determination of partition coefficient of between carbon tetrachloride and water.
Find out atomic parachor of carbon and hydrogen.
Colorimety :-
Verification of beer's and lamberts law and find out the concentration of unknown solution

Course Outcomes:
Afterthe completion of course learner should able to understand the following:

- Verification of Freundlich's Adsorption Isotherm.
- Determination of order of a reaction.
- Determination of solubility, dissociation constant and ionic strength.
- Rate constant
- Partition co-efficient
- Verification of Lambert beer Law.

Text book:

- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- Practical physical chemistry, A.M.James and F.E.Prichard Longman
- Practical Physical Chemistry, Gurdeep Raj, Goal Publication.

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SEMESTER- 2nd | **Subject Code: 4010211101**
Course: M.Sc. Chemistry | **Theory Max. Marks: 70**
SUBJECT: INORGANIC CHEMISTRY.-II | **Theory Min. Marks: 28**

Course objectives-

To understand general properties of non –transition elements and their specific compounds, organometallic compounds and their catalytic properties, lanthenides and actinides and its specific properties , non aqueous solvents and its various examples and nuclear and radioactive properties with various associated factors

UNIT-I

Chemistry of non – Transition elements : General discussion on the properties of the non – transition elements, special features of individual elements, synthesis, properties and structure of halides and oxides of the non – transition elements, Polymorphism in carbon, phosphorous and sulphur, Synthesis, properties and structure of boranes, carboranes, silicates, carbides, phosphazenes, sulphur – nitrogen compounds, peroxo compounds of boron, carbon,sulphur, structure and bonding in oxyacids of nitrogen,phosphorous, sulphur and halogens, interhalogens, pseudohalides.

UNIT-II

Organometallic Chemistry of transition elements:Ligandhapticity, electron count for different types of organometallic compounds, 18 and 16 electron rule ,synthesis, structure and bonding,organometallic reagents in organic synthesis and in homogeneous catalytic reactions (Hydrogenation, hydroformylation, isomerisation and polymerisation), pi metal complexes,

b) Metal – ligand equilibria in solution Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to nature of metal ion and ligand, chelate effect.

UNIT-III

Studies and applications of Lanthanides and Actinides : Spectral and magnetic properties, use of lanthanide compounds as shift reagents, Modern methods of separation of lanthanides and actinides, Organometallic chemistry applications of lanthanide and actinide compounds in Industries.

UNIT-IV

Chemistry in Non- aqueous solvents : Classification of solvents, properties, leveling effect, type reactions in solvents, chemistry of liquid ammonia, liquid dinitrogentetraoxide and anhydrous sulphuric acid with respect to properties, solubilities and reactions.

UNIT-V

Nuclear and radiochemistry : Radioactive decay and equilibrium, nuclear reactions, Q value, cross-sections, types of reactions, chemical effects of nuclear transformation, fission and fusion, fission products and fission yield

Course outcomes-After the completion of course learner should able to understand about

- non –transition elements and synthesis ,properties and structure of compounds of non transition elements.
- organometallic chemistry ,electron count ,catalysis and metal ligand equilibria.
- chemistry applications of lanthanide and actinide.
- solvents, properties and chemistry in non- aqueous solvents and olvents, properties .
- nuclear and radiochemistry with special reference to q value and cross section

References-

- J H Huheey, Inorganic Chemistry - Principles,structure and reactivity, Harper and Row Publisher, Inc New York (1972)
- J.D. Lee, concise inorganic Chemistry, Elbs with Champan and Hall, London
- T.S. Swain and D.S.T. Black organometallic Chemistry
- F.A. Cotton, R.G. Wilkinson. Advanced Inorganic Chemistry

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SEMESTER- 2nd **Subject Code: 4010211102**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: ORGANIC CHEMISTRY.-II **Theory Min. Marks: 28**

COURSE OBJECTIVES: The aim of this course is to provide a core for some basic reactions, organometalic compounds and reterosynthetic analysis to provide a good, solid grounding in the basics of organic chemistry

UNIT-I

Study of following reactions: Mechanism of condensation reaction involving enolatesMannich, Benzoin, Stobbe, Dieckmann, Diels-Alder, Robinson annulation Reimer-Tieman, Chichibabin, Baeyer Villiger oxidation

UNIT-II

Alkylation and Acylation: Introduction, Types of alkylation and alkylating agents: C-Alkylation and Acylation of active methylene compounds and Applications.

b) Hydroboration and Enamines : Mechanism and Synthetic Applications.

UNIT-III

Reductions : Study of following reductions- Catalytic hydrogenation using homogeneous and heterogeneous catalysts. Study of following reactions: Wolff-Kishner, Birch, Clemmensen, Sodium borohydride, Lithium Aluminium hydride (LAH) and Sodium in alcohol, Fe in HCl.

Oxidation : Application of following oxidizing agents: KMnO4, chromium trioxide, Manganese dioxide, Osmium tetraoxide, DDQ, Chloranil .

UNIT-IV

Study of Organometallic compounds: Organo-magnesium, Organo-zinc and Organo-lithium, Hg and Sn reagents; Use of lithium dialkylcuprate their addition to carbonyl and unsaturated carbonyl compounds.

UNIT-V

Methodologies in organic synthesis – ideas of synthones and retrones.Functional group transformations and interconversions of simple functionalities.

Course Outcomes: Students will be able torecognize, classify, explain, and apply fundamental organic reactions like condensation, acylation, alkylation, oxidation, reduction and use retrosynthetic analysis to design efficient multi-step syntheses.

Text book:

- Modern synthetic reactions- (Benjamin) H.O. House.
- Principles of organic synthesis- (Methuen) R.O. C. Norman
- Organic Chemistry (Longman) Vol.I& Vol. II- Finar
- Advanced Organic chemistry 2nd Ed. R R. Carey and R.J. Sundburg.
- Some modern methods of Organic synthesi- (Cambridge) W.Carruthares

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SEMESTER- 2nd **Subject Code: 4010211103**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: PHYSICAL CHEMISTRY-II **Theory Min. Marks: 28**

Course objective-
To understand general idea of photochemistry, photo physical phenomena, electrochemistry and chemical kinetics.

UNIT-I

PHOTOCHEMISTRY : Absorption of light and nature of electronic spectra, electronic transition, Frank-Condon principle, selection rules, photodissociation, predissociation, photochemical reactions: photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photochemistry of environment: Green house effect.

UNIT-II

Photo physical phenomenaI:: Electronic structure of molecules, molecular orbital,electronically excited singlet states, designation based on multiplicity rule, life time of electronically excited state, construction of Jablonski diagram, electronic transitions and intensity of absorption bands, photphysical pathways of excited molecular system(radiative and non-radiative).

UNIT-III

Photo physical phenomena II: Fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching: concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance enrgy transfer between photexcited donor and acceptor systems. Stern-Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisional V quenching and Stern-Volmer equation.

UNIT-IV.

ELECTROCHEMISTRY: 1. Arrhenius theory of electrolytic dissociation (Evidences and limitations), revision of basic electrochemistry(Types of electrodes and cells).

2. Electrochemical cells with and without transference, determination of activity coefficients of an electrolyte, degree of dissociation of monobasic weak acid (approximate and accurate), instability constant of silver ammonia complex. Acid and alkaline storage batteries.

UNIT-V

CHEMICAL KINETICS: Experimental methods of following kinetics of a reaction, chemical and physical (measurement of pressure, volume, EMF, conductance, diffusion current and absorbance) methods and examples. Order and methods of determination(Initial rate, Integration, graphical and half life methods), rate determining step, steady state approximation and study of reaction between NO2 and F2, decomposition of ozone, and nitrogen pentoxide. Kinetics of complex reactions, Simultaneous (first order opposed by first order), Parallel and Consecutive reactions.Examples and numericals.

Course outcomes-After completion of course learner should able to understand the followings:

- Photo physical and Photo physical phenomena
- Electrochemistry.
- Chemical Kinetics

Text book:

- Photochemistry- J.G. CalvertsandJ.N. Pitts, John- Wiley & Sons
- Fundamentals of Photochemistry- K. K. Rohatgi-Mukharjii, Wiley Eastern
- Advanced Physical Chemistry- Gurdeep Raj, Goel Publishing House

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 2nd **Subject Code: 4010211104**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: ANALYTICAL CHEMISTRY-II **Theory Min. Marks: 28**

Course objectives-
To understand general idea of UV-VIS, IR, NMR, Mass, Nephlometry and Turbidometry and Atomic Absorption Spectroscopy.

UNIT-I

a)Ultraviolet and visible spectrophotometry (UV-VIS):Introduction, Beer Lambert's law, instrumentation, calculation of absorption maxima of dienes, dienones and polyenes, applications.

b)Infrared Spectroscopy (IR) :Introduction, instrumentation, sampling technique, selection rules, types of bonds, absorption of common functional groups. Factors affecting frequencies,

applications.

UNIT-II

Nuclear Magnetic Resonance (NMR) : Magnetic and nonmagnetic nuclei, Larmor frequency, absorption of radio frequency. Instrumentation (FT-NMR). Sample preparation, chemical shift, anisotropic effect, spinspin coupling, coupling constant, applications to simple structural problems

UNIT-III

Mass spectroscopy : Principle, working of mass spectrometer (double beam). Formation of different types of ions, Mclafferty rearrangements, fragmentation of alkanes, alkyl aromatics, alcohols and ketones, simple applications, simple structural problems based on IR, UV , NMR and MS

UNIT-IV

Nephlometry and Turbidometry: Introduction, Theory, Instruments, working and Applications

b) Radiochemical Analysis, NAA: Scintillation counter and G.M. Counter (08)

UNIT-V

a) **Atomic Absorption Spectroscopy**: Introduction, Principal, difference between AAS and FES, Advantages of AAS over FES, advantages and disadvantages of AAS. Instrumentation, Single and double beam AAS, detection limit and sensitivity, Interferences applications.

b) Inductively coupled Plasma Spectroscopy Introduction, Nebulisation Torch, Plasmsa, Instrumentation, Interferences, Applications

Course outcomes-After completion of course learner should able to understand the followings:

- Determine the structure of molecule by IR, NMR and Mass spectra.
- Identification of sample by Nephlometry, Turbidometry, Atomic Absorption Spectroscopy.

Text book:

- Spectroscopic identification of organic compounds- R.M. Silverstein and G.C. Bassler
- Spectroscopic methods in organic chemistry- D.H. Williams and I. Fleming
- Absorption spectroscopic of organic molecules- V.M. Parikh
- Applications of spectroscopic techniques in Organic chemistry- P.S. Kalsi
- Physical Methods in Inorganic Chemistry (DWAP)- R. Drago
- dvanced spectroscopic methods- H. Kaur, PragatiPrakashan.

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 2nd | **Subject Code: 4010221101**
Course: M.Sc. Chemistry | **Theory Max. Marks: 100**
SUBJECT: Lab-I Organic Chemistry | **Theory Min. Marks: 50**

Course Objectives: The aim of this course is to provide the knowledge of basic and advanced laboratory procedures used in Qualitative and quantitative analysis in organic chemistry

Qualitative Analysis :-
Separation, Purification and identification of binary mixture (One liquid and one solid) using TLC and column chromatography. Chemical text, IR spectra may be used for functional group identification.
Organic Synthesis :-
Acetylation : of Cholesterol and separation of Cholesterol acetate by Column Chromatography.
Oxidation :Adipic acid by chromic acid, oxidation of cyclohexanol.
Grignard's reaction :Triphenyl methanol from Benzoic acid.
Aldolcondensation :Dibenzalacetone from Benzaldehyde
Sandmeyerreaction : P-chloro Toluene from Toluidine.
Friediel Craft's reaction : P-Benzoyl propanoic acid from succinic anhydride and Benzene.
Aromatic electrophilic substitution : P-nitro aniline from p-bromo aniline.
Product may be Characterised by Spectral techniques.
Quantitative analysis :-
Determination of the percentage number of hydroxyl groups by acetylation method.
Estimation of amine/phenols using Bromate Bromide method of Acetylation method.
Estimation of Carbonyl group by hydrazone method.
Estimation of Glycine by titration.
Determination of equivalent weight of carboxylic compounds.Estimation of carboxyl group by titration/Silver salt method.

Course Outcomes: Students will gain an understanding of analysis of binary mixture, estimation of functional group,organic synthesis including spectroscopic and analytical techniques for identification and characterization.

Text book:

- Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
- Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
- Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
- Experimental Physics Chemistry R.C. Das and Beher, Tata McGraw Hill.

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SEMESTER- 2nd | **Subject Code: 4010221102**
Course: M.Sc. Chemistry | **Theory Max. Marks: 100**
SUBJECT: Lab-II Analytical Chemistry | **Theory Min. Marks: 50**

Course Objective

To perform quantitative analysis of Ores/alloys along with the determination of complex composition and separation of different metal ions using ion-exchange method.

(Instrumentation and Computers)

Error analysis & Statistical data analysis :-
Error, types of errors, minimization of errors, statistical treatment for error analysis standard deviation, Relative standard, Linear Least Squares.
Calibration of Volumetric apparatus, burettes, pipettes, standard flask, weight box etc.
Volumetric analysis :-
Basic principles. Determination of iodine and saponification values of oil sample Determination of DO, COD, BOD, Hardness of water samples.
Gravimetric analysis :-
Determination of metal ions eg. Ni, Cu etc. by gravimetric methods using organic precipitants such as dimethyglyoximedithizone, 8-hydroxyguinoline, etc.
Chromatography :-
Separation of cations and anions by-
Paper chromatography (b) Column Chromatography
pHmetry / potentiometry : Determination of strength of acids etc.
Flame Photometry / AAS/ FIA/ Colorimetrty :-
Determination of cations/anions and metal ions, e.g. Na+, K+, Ca2+, SO42- , NO2-, Fe, Mo, Ni, Cu, Zn, etc.
Spectrophotometry :-
Verification of Beer-Lambert Law.Molar absorptivity calculation, plotting graph to obtain □□max etc.Effect of pH in aqueous coloured systems. Determination of metal ions, e.g. Fe, Cu, Zn, Pb, etc. using inorganic reagent like SCN and organic chelating agent like dithizone, cuferron 8-hydroxyquinoline, etc. in aqueous/organic phase in the presence of surface active agents.
Nephelometry / Turbidimetry :-
Determination of chloride, sulphate, phosphate, turbidity, etc.
Application of computers in chemistry :-
As specified in theory paper in Sect. II (a)

Course Outcome:

- Determination of complex composition and stability constant of a complex by Job's method spectro - photometrically
- Determination of DO, COD BOD Hardness of water sample.
- Determination of total cation concentration and separation of different metal ions using cation exchange resin.
- To separated cation and anion by Chromatography.
- Determination of half-cell potential of Cd(II) ion in KCl solution and estimation of Cd(II) ion in unknown solution by polarography.

Text book:

- Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
- Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
- Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
- Experimental Physics Chemistry R.C. Das and Beher, Tata McGraw Hill.

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code: 4010311101**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: APPLICATION OF SPECTROSCOPY **Theory Min. Marks: 28**

Course objectives-

To understand general idea of rotational spectra, molecular spectra, NMR, ESR.NQR, Photoelectron and Mossbauer spectra.

UNIT-I :ROTATIONAL-Vibrational Spectroscopy: Microwave Spectroscopy: Classification of molecules, rigid rotor model, effect of isotopic substitution on transition frequencies, intensities, non-rigid rotor. Applications. Vibration-rotation spectroscopy, P,Q,R branches. Breakdown of Born-Oppenheimer approximation, vibration of polyatomic molecules, normal modes of vibration, group frequencies, overtones, hot bands, factor affecting the band positions and intensities, far IR region, metal-ligand vibrations. Normal coordinate analysis.

UNIT-II :Molecular Spectroscopy: Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radio-active and non-radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra.Raman Spectroscopy: Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, application of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins, coherent anti stokes Raman spectroscopy (CARS).

UNIT –III: Nuclear Magnetic Resonance Spectroscopy: General introduction, chemical shift, spin-spin interaction, shielding mechanism, chemical shift values and correlation of protons present indifferent groups in organic compounds. Chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei, virtual coupling.factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.). Stereochemistry, hindered rotation, Karplus- relationship of coupling constant with dihedral angle. Simplification of complex spectra-nuclear magnetic double resonance, spin tickling, INDOR, contact shift reagents, solvent effects. Fourier transform technique, Nuclear Overhauser Effect (NOE). Introduction to resonance of other nuclei –13C, 19F and 3 IP, FT NMR, advantages of FT NMR. Principle and introduction to C13 NMR, 2-D and 3-D NMR, Applications of NMR .

UNIT-IV: PHOTOELECTRON AND ESR SPECTROSCOPIES: Valance and core binding energies – Measurement technique – Koopman's theorem – Chemical shifts in X-ray photoelectron spectroscopy – Auger spectroscopy – Applications of ESCA in chemistry.Electron spin Resonance Spectroscopy – Origin of the spectrum – method of recording - hyperfine splitting – g value and hyperfine splitting constant - McConnell relationship. Zero field splitting ESR spectra of simple organic radicals - application of ESR spectra to transition metal complexes

UNIT-V :NQR AND MOSSBAUER SPECTROSCOPIES: NQR spectroscopy – Theory of NQR – instrumentation – Nuclear quadrupole coupling constants – effects of magnetic field on the spectra – relation between electric field gradient and structure – Applications.Mossbauer spectroscopy – principle – source and absorber – isomer shift – quadrupole splitting – magnetic interactions – applications to Fe and Sn compounds.

Course Outcome: After the completion of course learner should able to understand the following:

- Knowledge about molecular vibration and rotational spectra.
- Knowledge about Raman spectroscopy.
- Knowledge about ^{1}H NMR, ^{13}C NMR, ^{19}F, ^{31}P and correlation spectra.
- Knowledge about ESR.
- Knowledge about NQR and Mossbauer spectra.

Text book:

- V.M. Parikh, Application spectroscopy of organic molecules. (Mehata)
- Silverstein and Basallar, Spectroscopic methods of organic compound.
- P.S. Kalsi Spectroscope of organic compounds (New age publisher)
- J.R. Dyer. Application of absorption spectroscopy of organic compounds.
- W. Kemp, Organic spectroscopy ELBS

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code: 4010311102**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Bio Organic, Bio-Inorganic & Environmental chemistry (Compulsory paper) **Theory Min. Marks: 28**

Course Objectives- To understand the general idea of bioinorganic chemistry and common environmental pollution

UNIT-I

Metals in Life Processes : Na+-K+-Pump charge carriers & osmotic pressure, relation to sensitivity of nerves and control on muscles, Mg-Ca complexes with nucleic acid, nerve impulse transmission, trigger reaction, Mn, Fe, Co, Cu, Mo, ferridoxins, Zn-super acid catalysis.

Trace Metals in Plant Life : Micronutrients in soil, role of micronutrients in plant life.

UNIT- II

Metalloenzymes

Preliminary idea about enzyme, co-enzyme and metalloenzyme, Enzyme-substrate binding problem, The Michaelis-Menten's equation, carboxypeptidase, carbonic anhydrase and their biological significance, oxydases, nitrogenases and its role in nitrogen fixation, Interchangeability of zinc and cobalt enzyme Supramolecular Chemistry**:** Host guest chemistry, chiral recognition and catalysis, molecular recognition, biomimetic chemistry, crown ethers, cryptates. Cyclodextrine, cyclodextrinbased enzyme models, calixarenes, Ionophores.

UNIT- III

Metalloporphyrins And Iron-sulphur Protein

Iron porphyrins (Heme proteins): Hemoglobin (Hb), Myoglobine (Mb) their behavior asoxygen carrier and oxygen uptake protein, O2 affinity cooperativity and Bohr's effect, Heme protein as electron carrier with particular reference to reference to cytochrome-c and cytochrome-450, and cytochrome oxydase. Magnesium porphyrins (Chlorophyll): Photosynthesis, the light and dark reaction (Calvin cycle). Non-heme iron-sulphur protein as electron carrier, rubredoxins and ferredoxins.

UNIT-IV

[A] Air Pollution : Classification & effects of air pollutants on living and nonliving things, , green house effect, acid rain, ozone depletion and their consequences on Environment

[B] Water pollution : Types, sources and classification of water pollutants, Industrial water pollution, , industrial water, Effects of water pollutants on life and Environment.

[C] Method of control of water pollution : Water and waste water treatment, aerobic and anaerobic, aeration of water, principle of coagulation, flocculation, softening, disinfection, demineralization and fluoridation.

UNIT-V

[A] Radiation pollution-: classification & effects of radiation, effects of ionizing radiation on man, Effects of non ionizing radiation on life, radioactivity and Nuclear fallout, protection

[B] Environmental toxicology Chemical solutions to environmental problems biodegradability, principles of decomposition better industrial processes, Bhopal gas tragedy, Chernobyl, three mile island, sewozo and minamata disasters. n and control from radiation.

Reference Book

- Elements of Inorganic Photochemisty, G.J.Gerrandi Wiley.
- Environmental Pollution, A.K.De
- Environmental Pollution Control in Process Industries, S.P.Mahajan
- Introduction to Air Pollution P.K.Trivedi
- Environmental Pollution Analysis, S.M.Kharpkar
- Environmental Pollution Engineering and Control, C.S.Rao
- Environmental Chemistry, B.K. Sharma &H.Kaur.
- Principles of Biochemistry, A. L. Lehinger, Worth Publications.
- 2. Biochemistry, Voet and Voet, John Wiley.

- 3. Basic Inorganic Chemistry (3rd ed) : Cotton ,Wilkinson & Gaus.
- 4. Inorganic chemistry (4th Ed) : Huheey, Keiter & Keiter.
- 5. Bioinorganic and Suparmolecular Chemistry: Bhagi, G.R.Chatwal.
- 6. Bio-Inorganic chemistry : E.Ochiai.
- 7. Bio-Inorganic chemistry : R.W. Hay.

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SEMESTER- 3rd **Subject Code: 4010311103**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Organic Chemistry (Elective Paper I) **Theory Min. Marks: 28**
Applied Organic Chemistry

Course objectives- The student will have a general overview of the most significant applications in industrial organic chemistry eg agrochemicals, dyes,polymers and soaps and detergents , together with a basic knowledge of the socio-economic impact of chemistry

UNIT-I

Agrochemicala. Carbamate pesticides: Introduction, carbaryl, Baygon, Aldicarb, Ziram, Zineb b. Organophosphorus pesticides: Malathion, monocrotophos, dimethoate, phorate, mevinphosc. Natural and synthetic pyrethroids : Isolation and structures of natural allethrin, fenvalerate, cypermethrin,d. Plant growth regulators: General survey synthesis of simple compounds e. Insect repellents: General survey and synthesis f. Jovenileharmone: introduction structures JHA importance synthesis g. Pheromones: introduction, examples, and importance in IPM synthesis of juvabionebombycol, grandisol, and disparure

UNIT-II

Manufacture of following:

2-Phenylethanol, detergents, vanillin and other food flavours, synthetic musk, Acetic acid and butenaldehyde from ethanol butyl acetate, furfural, from bagasse, citric acid from molasses, Application of oro and marker process. Nicotine from tobacco waste and citral from lemon grass, synthetic detergents, glycerol.

UNIT-III

Dyes and Intermediates : Synthesis of important dye intermediates. Commercial processes for Azo dyes, reactive dyes, optical brighteners, thermal sensitive dyes, dispenses dyes.

UNIT-IV

Polymers: Mechanism of polymerization. Study of polyesters, polyamides, PVC, polystyrene, polyvinyl acetate and polyvinylalcohol, polyethenes, viscose rayon, synthesis of polyethylene, polypropylene. Synthetic rubbers: Styrene-butadiene, butyl polyisoprene, phenol formation formaldehyde resin. Plastictisers and anti oxidants for polymers, Natural polymers: Starch and cellulose.

UNIT-V

Soap and detergents: Soap -Introduction, method of preparation of soap, types of soap, cleaning mechanism, limitation of soap as cleaning agent. Detergents- Introduction, types of detergents, the mechanism of cleaning action of detergents,advantage of using detergent ,washing powder.

Course outcomes-After the completion of course learner should able to understand about

- About the synthesis and application of various classes of agrochemicals.
- Manufacture of different valuable chemical used in industries.
- Complete knowledge of different classes of dyes and intermediate
- About polymer synthesis and applications.

About chemistry and applications of soap and detergents

Text book:

- K. Venkataraman: Chemistry of Synthetic Dyes vol- 1to 7
- K. H. Buchel: Chemistry of Pesticides
- R. Cleymlin: Pesticides
- ShashiChawla, Engineering Chemistry, DhanpatRai and Co (P) Ltd

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code: 4010311104**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Organic Chemistry (Elective Paper II) **Theory Min. Marks: 28**
DRUG & HETEROCYCLIC COMPOUNDS

Course objectives- To understand general idea of Drug design and heterocyclic chemistry.

UNIT-I

a) Drug design :Development of new drugs, procedures followed in drug design, concepts of prodrugs and soft drugs. Theories of drug activity, Quantitative structure activity relationship. Theories of drug activity, Quantitative structure activity relationship. History and development of QSAR. Concepts of drug receptors b) Study of the Following types of drugs:I

a) Antibiotics: Preparation of semi synthetic penicillin, conversion of penicillin into cephalosporin, general account of tetracycline &macrocyclicantibiotics(no synthesis)

b) Antimalerials: Trimethoprim

c) Analgesic & Antipyretics: Paracetamol, Meperidine, methadone, Aminopyrine.

UNIT-II

a) b) Study of the Following types of drugs:II

i) Anti- inflammatory: Ibuprofen, Oxyphenylbutazone, Diclophenac, Indomethacin.

ii) Antitubercular&antileprotic :Ethambutol, Isoniazide&Dapsone

iii) Anaesthetics :Lidocaine, Thiopental.

iv) Antihistamines: Phenobarbital, Diphenylhydramine.

v) Tranquilizers: Diazepam, Trimeprazine.

vi) Anti AIDS: General study

vii) Cardiovascular: Synthesis of dilliazem, quinidine, methyldopa, atenolol, oxyprenol

viii) Anti-neoplastic drugs: Cancer chemotherapy, Synthesis of mechloraethamine, cyclophosphamide, Mephalan, uracils, mustards. Recent development in cancer chemotherapy.Hormones and natural products.

UNIT-III

a) Small ring Heterocycles

Three membered and four membered Heterocycles- synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxitanes and thietanes.

b) Benzo fused five membered Heterocycles. Synthesis and reactions of benzopyrroles, benzofurans and benzothiophenes.

UNIT-IV

a) Six membered Heterocycles with one heteroatom

Synthesis and reactions of pyrilium salts and pyrones and their comparison pyridinium and thiopyrylium salts and pyridones. Synthesis and reactions of coumarins, chromones.

UNIT-V

a) Six membered Heterocycleswith two and more HeterocyclesSynthesis and reactions of diazines&triazines.

b) Seven membered HeterocyclesSynthesis and reactions of azepines, oxepines&thiepines.

Course outcomes-After the completion of course learner should able to understand about

- About the synthesis and application of various classes of drugs.
- knowledge of heterocyclic compounds

Text book:

- Burger : Medicinal chemistry.
- A. Kar : Medicinal Chemistry (Wiley East)
- Wilson, Gisvold&Dorque: Text book of organic medical and pharmaceutical chemistry
- R. M. Acheson : An introduction to chemistry of heterocyclic compounds (Interscience).
- Joule & Smith: Heterocyclic chemistry (Van Nostrand).
- R.K. Bansal: Hetterocyclic chemistry (Wiley E).
- Finar : Organic chemistry (Vol.1& 2)
- Heterocyclic Chemistry, J.A. Joule, K Mills and G.F. Smith, Chapman and Hall
- Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical
- An Introduction to Heterocyclic Compounds, R.M. Acheson, J. Willey

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SEMESTER- 3rd **Subject Code: 4010311105**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Inorganic chemistry (Elective paper-I) **Theory Min. Marks: 28**
Chemistry of Inorganic Materials

Course objectives-
To understand general idea of Inorganic materials with reference to lattice defect, ionic conducter, magnetic property.

UNIT-I
A] Lattice Defects
Introduction to types of Solids, Perfect & imperfect crystals, point defects, Line defect and plane defect defect (definition & explanation of meaning) order & disorder phenomena, thermodynamics of Schottky&frenkel defect formation, Determination of defect, Nonstiochiometric defect (structural and thermodynamic aspects) incorporation of stiochometric excess of defects, thermodynamics of Nonstiochiometric phases.

UNIT-II
B] Synthesis of Inorganic materials
Synthesis of solid state materials using different techniques ceramic techniques, coprecipitation techniques, sol gel techniques, precursor techniques, high temperature & high pressure synthesis.

UNIT-III
A] Ionic Conductors
Types of ionic conductors, mechanism of ionic conduction, interstitial jumps, vacancy mechanism, diffusion, super ionic conductors, phase transition classification& mechanism of conduction in super ionic conductors, examples and applications of ionic conductors.
B] Electronic properties of materials Band Theory-N Type & P Type

UNIT-IV
A] Magnetic properties of Materials
Introduction, Magnetization, Electron spin and magnetic moment, Theory of diamagnetism, langevins theory & paramagnetic susceptibility of solids, ferromagnetism, Domain theory. Hysteresis in magnetism, ferrimagnetisms (ferries) Applications of magnetic materials.
B] Magnetic Materials
I] Structure and Properties of i) Metal and Alloys ii) SMA-Shape Memory Alloys.

UNIT-V
A] Advanced Inorganic Materials
Nanotechnology and its business applications, Introduction to nanoscale, Potential applications of nanomaterials, Challenges and opportunities scope of nanotechnology, Commercialization scope Nanotechnology research in 21st century, Basic nanotechnology science and chemistry concepts, basic nanostructures , nanocomposites, Thin films, nanofoam, nanoclusters, smart nanostructures, manufacturing techniques of nanomaterials.

Course outcomes-After the completion of course learner should able to understand about

- About the inorganic materials and its special properties.

Text book:

- N.N. Greenwood: lonic Crystals, Lattice Defects and Nonstionchiometry (Butterworth's)
- A. R. West, Solid State Chemistry
- H.V. K Keer, Principles of the Solid State Chemistry, Wiley Eastern.

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SEMESTER- 3rd **Subject Code: 4010311106**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Inorganic chemistry (Elective paper-II) **Theory Min. Marks: 28**
Co-ordination chemistry

Course objective-
To lern about Basic term, Properties, Classification of coordination complete and geometry and application.

UNIT-I
Theories of Metal-Ligand bonding
Molecular Orbital treatment, Octahedral (with and without pi bonding) tetrahedral and square planer complexes in a qualitative manner, comparison of theories of bonding, VBT, CFT, LFT and MOT.

UNIT-II
Structural studies of coordination compounds
Compounds of transition series elements, electronic spectra, magnetic& thermal properties, Microstates and term symbol.charge transfer spectra, molecular term symbol.

UNIT-III
Magneto Chemistry
Diamagnetic correction, single &multielectron system, types of the magnetic behaviour, Diamagnetism, Para magnetism, Ferro &Ferri, Antiferro and magnetic interaction, The origin of Para magnetism, Magnetic behavior of complexes, Simplification of Van Velck equation, magnitude of magnetic moments, Determination of magnetic susceptibility by Gouy and faraday method.

UNIT-IV
Transition metal complexes & catalysis
Introduction, General Principle, Orgeldiagram,trans effect, Stability of complex: thermodynamic and kinetic stability, substitution reaction in octahedral complex, Arene reactions catalyzed by metal complexes, catalysis of condensation polymerization reaction, Current and feature trend in catalysis.

UNIT-V
Chemistry of Non-transition elements
Zeolites and their uses, lameller compounds, cryptatecomplexs,structure of boranes,borazines – preparation structure and bonding, pseudohalides, metal clustureiso and heteroacids – polihalides, wades rules –boranes and carboranes

Course Outcomes
To trend about application and various properties of Coordination complex and their mechanism.

Text book:

- Jones: Elementary Coordination Chemistry J. Weily
- Graddon: Introduction to Coordination Chemistry J. Weily
- Drago: Physical methods of Inorganic Chemistry. J. Weily
- Datta&Shymlal Elements of Magneto Chemistry
- James E. Huheey: Inorganic Chemistry Principles of Structure and reactivity, harber& Row, Publishers Inc. New York 1972.
- William L. Jolly: Modern Inorganic Chemistry Mecgrow Hill USA, 1984
- F.A. Cotton & R.G. Willkinson: Advanced Inorganic Chem.

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SEMESTER- 3rd **Subject Code: 4010311107**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Physical Chemistry (Elective paper-I) **Theory Min. Marks: 28**
Advanced Chemical Kinetics

Course Objective -To understand the brief idea and derivations of Chemical kinetics,electron transfer reaction and catalysis

Unit-I:
Chemical kinetics: Steady State Approximation Collision theory of gas reaction , collision frequency. The rate constant , molecular diameters , collision theory vs. experiment Kinetics of Fast reactions: Relaxation techniques, pressure jump and temperature jump methods, NMR relaxation, flash photolysis and molecular beam methods.

Unit-II
Hydrogen ion dependence of reaction rates: Protonation and hydrolysis equilibria, determination of active reactant species form kinetic data, interpretation of hydrogen ion effect with example.

Unit-III
Electron transfer reaction: Complimentary and non-complimentary reactions, outer and inner-sphere electron transfer reactions, proton transfer, hydride transfer and hydrogen, oxygen and chlorine atom transfer reactions.

Unit-IV
Catalysis: Trace metal ion catalysis and their mechanisms. Micellar catalysis, Berezini, Menger-Portonoy, cooperative and pseudo-phase ion exchange models andexamples.

Unit-V
Mechanism of chromium(VI) oxidations: One and two equivalent reductants oxidation, assumptions, limiting forms of rate laws, Westheimer mechanism and its validity. Catalysis, Induced and cooxidations.Mechanisms other than Westheimer mechanism.

Course Outcomes- Course completion give rise to the following outcomes

- To determine the rate cdonstant
- To determine the kinetics of fast reaction
- To understand the transition metal catalysis

Text book:

- Text book of Physical Chemistry- S. Glasstone
- Physical Chemistry- G.M. Barrow, Tata-McGraw Hill, Vth edition, 2003
- Physical Chemistry- G.K. Vemulapalli, Prentice-Hall of India, 1997.
- A Text book of Physical Chemistry- A.S. Negi- New Age International
- A Text book of Physical Chemistry- K.L. Kaboor (Vol.I- IV) Mecmillan India Limited.
- Advanced Physical Chemistry- J.N. Gurtu R A Gurta, PragatiPrakashan.
- Advanced Physical Chemistry – Gurdeep Raj Krishran Publication.
- Physical Chemistry- Puri, Sharma &Parhalia, Vikash Publication.

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SEMESTER- 3rd **Subject Code: 4010311108**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Physical Chemistry (Elective paper-II) **Theory Min. Marks: 28**
Electrochemistry

Course objectives- To study the electrolytic conduction and electro-kinetic phenomenan including electro-analytical methods

Unit - I

Electrolytic conductance: Debye - Huckel theory of inter-ionic attraction , ionic atmosphere, time of relaxation, relaxation and electro-phoretic effects, Debye-Huckel-Onsagar equation and its validity for dilute solutions and at appreciably concentrated solutions. Abnormal ionic conductance of hydroxyl and hydrogen ions.Activity coefficients: forms of activity coefficients and their interrelationship. Debye-Huckel limiting law its applications to concentrated solutions. DebyeHuckel

Unit - II

Ion solvent interactions and electrolysis: The Born Model and expression for the free energy of ion- solvent interactions.Thermodynamic parameters for the ion - solvent interactions.Calculations of heats of hydration of ions and the concept of hydration number.Electrolysis: Decomposition potentials: calculations and determinations.Polarization: types of polarization, over voltage and hydrogen and oxygen over voltage.

Unit – III

Electrode reactions.: Tafel equations, kinetics of discharge of hydrogen ions . Diffusion over potentials.Fuel cells: significance of fuel cells: hydrogen - oxygen, hydrocarbon - air, natural gas and carbon monoxide, air fuel cells. Corrosion: concept and importance, mechanism of corrosion and Pourbaix diagrams.

UNIT-IV

Electrokinetic phenomena: Electrical double lever, theories of double layer,electro-capillary phenomena, electro-capillary curve. Electro-osmosis, electrophoreses. Streaming and Sedimentation potentials. Zeta potentials and its determination by electrophoresis, influence of ions on Zeta potential.

UNIT-V

Electroanalytical Methods - Potentiometric methods: Reference electrodes and indicator electrodes. The hydrogen calomel, Ag-AgCl electrodes.The glass electrode – its structure, perofrmance and limitations.Measurement of pH.Petentiometric titrations.Redox and precipitation titrations.Electrogravimetry: Principle and method. Determination of Cu. Separation of metals.Conductometry: Principle and method. Conductance measurements.Conductometric titrations.Colorimetry: Principle and method. Colorimetric titrations.

Course Outcomes- Course completion give rise to the following outcomes

- To determine the electrolytic conduction.
- To determine the polarization.
- To understand the potentiometric and colorimetric titratation.

Reference Books:

- An introduction to Electrochemistry by S.Glasstone
- Modern Electrochemistry Vol. I & II by J.O.M. Bockris and A.K.N.Reddy.
- Physical Chemistry by S.Glasstone.
- Electrolytic Solutions by R.A.Robinson and R.H.Strokes
- Physical Chemistry by P.W.Atkins. ELBS

Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code: 4010321101**
Course: M.Sc. Chemistry **Theory Max. Marks: 100**
SUBJECT: LAB GENERAL-I **Theory Min. Marks: 50**

Course Objectives- determination of some sample by Volumetric, Spectrophotometry, Flame Photometry and Chromatographic way.

Volumetric Analysis :-

Alkalimetry,Determination of DO, BOD, CODand Chloride.

Complexometric Analysis:

Hardness of water samples.Determination of Ca and Mg.

Colorimetry and Spectrophotometry :-

Verification of Beer-Lambert Law.Preparation of standard curve.Determination of anions e.g. SO_4^{2-}, NO_3^-, F^-, PO_4^- etcspectrophotometrically.

Determination of metal ions, e.g. B, Fe, Cu, Zn, Pb, Mn, Cr, Hgetc. using inorganic reagent like SCN and organic chelating agent like dithizone, cuferron, 8-hydroxyquinoline, etc. in aqueous/organic phase in the presence of surface active agents.

Flame Photometry / AAS:-

Determination of Na, K etc. by Flame photometric Methods.

Determination of Heavy metals by Flame Atomic Absorption Spectrophotometric Methods.

Chromatography :-

Separation of cations and anions by-

Paper chromatography (b) Column Chromatography

Course Outcomes-After the completion of course learner should able to understand about

- Qualitative Analysis (Titriometric)
- Colorimetric analysis
- Chromatography techniques.

Text book:

- Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
- Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
- Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
- Experimental Physical Chemistry R.C. Das and Beher, Tata McGraw Hill.
- Analytical Chemistry,Alka L. Gupta, Pragati Publication, 5th ed.
- Advanced Inorganic Chemistry, S.K. Agarwala and KeemtiLal, 12thed.

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SEMESTER- 3rd **Subject Code: 4010321102**
Course: M.Sc. Chemistry **Theory Max. Marks: 100**
SUBJECT: LAB SPECIAL ELECTIVE (ORGANIC CHEMISTRY) **Theory Min. Marks: 50**

Course Objectives- Synthesis and identification of organic compounds; Separation and identification of organic constituents from natural sources.

Qualitative Analysis
Separation,purification and identification of the components of a mixture of binary organic compound and mixture of three organic compounds.
Volumetric Analysis:
Determination of iodine and saponification values of oil sample
Multi-step synthesis of organic compounds –
The exercises should illustrate the use of organic Reagents and may involve purification of the products by chromatographic techniques.

1.Photochemical reaction :
Benzophenone→Benzophenacol –Benzpinacolone
2. Beekmannrearrangement :
Benzanilide from benzene
3. Benzilic acid rearrangement :Benzilic Acid from benzoine
Benzoine→Benzine→Benzilic acid
4 Synthesis of hetrocyclic compounds
Skraup Synthesis preparation of quinoline from aniline
Fisher-indol Synthesis:preparation of o 2 phenyl –indole from phenyl hydeazine
5 Sandmayer reaction : preparation of o cholobenzoicacid from anthranilic acid .
6. Ullman reaction -preparation of N-Phenyl anthranilic acid from o cholobenzoicacid
7. preparation of Acriodone from N-Phenyl anthranilic acid.
8. preparation of p nitro aniline.
9 preparation of p bromo aniline.
10. preparation of methyl orange from analine via subphanilic acid.

Extraction of of organic Compounds
1. Isolation of Caffeine from Tea Laef
2. Isolation of Casine from Milk
3. Isolation of Lactose from Milk
4. Isolation of Nicotine dipicrate from Tobaco
5. Isolation of Piperine from Black Pepper
6. Isolation of Lycopene from Tomato
7. Isolation of β Carotene from Carrots.

Chromatographic Techniques:
Seperation and identification of the sugar, dyes and amino acids present in the given mixtures of dyes and amino acids by paper chromatography and determination of R_f values.
Seperation and identification of organic compounds by column chromatographic techniques.

Spectroscopy:
Identification of oraganic compounds by the spectral data (UV, IR, PMR, CMR& Mass Spectra).
Spectrophotometric (UV/VIS) estimations of Amino acids, Proteins, Carbohydrates and Drugs.

Course Outcomes-After the completion of course learner should able to understand about

- Synthetic and identification techniques of organic compounds
- Seperation and identification of organic component by column chromatographic techniques.

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SEMESTER- 3rd **Subject Code: 4010321103**
Course: M.Sc. Chemistry **Theory Max. Marks: 100**
SUBJECT: LAB SPECIAL ELECTIVE (INORGANIC CHEMISTRY) **Theory Min. Marks: 50**

Course Objectives- Separation and determination of two metal ions: Cu- Ni, Zn-Ni,Mg-Ni involving volumetric & gravimetric method
Instrumental methods and Analytical Technique. Preparation of some complex compounds

Spectrophotometric determination
Manganese/Chromium/Vanadium in steel sample.
Iron-salicylic aicd complex by jobs method of continuous variation of concentration.
Zirconium-Alizarin red –s-complex; Mole ratio method.
Copper Ethylenediamine Complex; Slope ratio method.
Separation& determination of two metal ions: Cu- Ni, Zn-Ni,Mg-Ni involving volumetric & gravimetric method.
Polarography
Composition and stability constant of complexes.
Flame photometric determination
Sodium and potassium when present together
Lithium/Calcium /Barium/ Strontium
Cadmium and Magnesium in tap water
Quantitative &Qualitative Analysis :
Paper chromatography- Cadmium and Zinc, Zinc and Magnesium
Thin layer chromatography – separation of Nickel, Manganese, Cobalt and Zinc. Determination of Rf values.
Ion Exchange
Solvent Extraction
Electrophoretioc separation.
F. i) Analysis of Dolomite.
ii) Estimation of available oxygen in H2 O2 by Iodometry.
G. Preparation of selected Inorganic compounds and study of their properties by various method including IR, Electronic Spectra, Mossbaur, ESR, Spectra magnetic susceptibility etc.
$Vo(acac)_2$, Cis& Trans K $[Cr(C_2O_4)_2(H_2O)_2]$. $2H_2O$, $Na[cr(NH_3)_2(SCN)_4]$, Mn (acac), K3[Fe(C2O4)3], Prussian Blue, Turnbulls Blue, [Co(NH3)6][Co(NO2)6], Hg [Co (SCN)4], [Ni (NH3)4] Cl2, Ni (DMG)2, [Cu(NH3)4]SO4, Mohr's salt, Nickel ammonium Sulphate

Course Outcomes-After the completion of course learner should able to understand about

- Quantitative &Qualitative Analysis
- Paper chromatography- Cadmium and Zinc, Zinc and Magnesium
- Thin layer chromatography – separation of Nickel, Manganese, Cobalt and Zinc. Determination of Rf values.

References

- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- The analysis of minerals and ores of the rarer elements-W.R.Schoeller and A.R.Powell, Charles, Griffin and company Ltd.
- Practical Inorganic Chemistry, Gurdeep Raj, Goal Publication.

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SEMESTER- 3rd **Subject Code: 4010321104**
Course: M.Sc. Chemistry **Theory Max. Marks: 100**
SUBJECT: LAB SPECIAL ELECTIVE (PHYSICAL CHEMISTRY) **Theory Min. Marks: 50**

Course Objectives- Determination of sample by Conductometric, Colorimetric .pH metric and Potentiometric method

Conductometry
i) Verify Debye Huckel and Onsager limiting law for strong electrolyte.
ii) Determine the degree of hydrolysis and hydrolysis constant of
CH3COONa (b) NH4Cl
iii) Determine the basicity of an organic acid by conductometric measurements
iv)Determine the equivalent conductance of an electrolyte and determine the dissociation constant .
V) Determine solubility of sparingly soluble salts .
B. Colorimetry
i) Determine the composition of K2Cr2O7 and KMnO4 using spectrophotometer
ii) Determine the dissociation constant of methyl red by spectrophotometric method .
C.pHmetry
i) Determine pK value of given dibasic acid by pH meter.
ii) Determine the pH of various mixtures of acetic acid and sodium acetate in aqueous solution and hence determine the dissociation constantof the acid.
D.Potentiometry
i) Titrate ferrous ammonium sulphate against K2Cr2O7/KMnO4 and determine redox potential of ferric system .
E. Distribution coefficient
i) Determine the distribution coefficient of succinic acid between ether and water.
ii) Study the distribution of benzoic acid between benzene and water, and hence show that benzoic acid dimerises in benzene
iii) Determine the equilibrium constant of the reaction KI+I2-KI3 by distribution method.

Course Outcomes-After the completion of course learner should able to understand about

- Conductometric Analysis.
- Colorimetric analysis
- pH metric and Potentiometric techniques

References

- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- The analysis of minerals and ores of the rarer elements-W.R.Schoeller and A.R.Powell, Charles, Griffin and company Ltd.
- Practical Inorganic Chemistry, Gurdeep Raj, Goal Publication.
- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- Practical physical chemistry, A.M.James and F.E.Prichard Longman
- Practical Physical Chemistry, Gurdeep Raj, Goal Publication.

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SEMESTER- 4rth **Subject Code: 4010411103**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Organic Chemistry (Elective paper-III) **Theory Min. Marks: 28**
Natural Products & Photochemistry

Course Objective-To understand broad classification of natural products. Isolation, biosynthesis and stereo/enantio-selective synthesis of representative examples from the domain of Alkaloids, Steroids, Terpenes, Prostaglandins, vitamins and basic concept of Photochemical reactions.

UNIT-I
Terpenoids (10+2): Structure and synthesis of abietic acid, zingiberene, santonin, cuparenonne and caryophyllene.
Alkaloids : Structure, stereochemistry, synthesis and biosynthesis of the following Structure of morphine, reserpine, ephedrine, (+) Conin.

UNIT-II
a) Steroids: Occurrence, nomenclature, basic skeleton, Diels hydrocarbon and study of the following hormones, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone and cartisone. Biosynthesis of steroids.

UNIT-III
Biogenesis: Alkaloids (pyridine, morphine and indole type) terpenoids of classes with examples, cholesterol, flavones, coumarins, carbohydrates and proteins.
Vitamins: Synthesis and structure of biotin and vitamin B2, synthesis of vitamin B1, biological functions of B6, B12, folic acid and thiamin.

UNIT-IV
Photochemistry- I: Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions, phtodissociation gas phase photolysis, photochemistry of alkynes, intramolecular reactions of the olefinic bonds, geometrical isomerism, cyclisation reactions, rearragements of 1,4 and 1,5 dienes,

UNIT-V
Photochemistry- II : photochemistry of carbonyl compounds, intramolecular reactions of carbonyl compounds saturated cyclic and acyclic ,α β unsaturated compounds, cyclohexadinones, intermolecular cycloaddition reactions, dimerisation and oxitane formation, photochemistry of aromatic compounds, miscellaneous photochemical reactions, photo fries reactions of anilides, photo fries rearrangements. Singlet molecular oxygen reactions, photochemistry of vision.

Course outcomes-After the completion of course learner should able to understand about

- About extraction ,structure elucidation and synthesis of terpenoids.
- About extraction ,structure elucidation and synthesis of alkaloids.
- About extraction ,structure elucidation and synthesis steroids.
- Biogenesis of different natural products.
- About extraction ,structure elucidation and synthesis vitamins.
- About photochemistry of organic compounds.

Reference Books:

- Apsimon: The total synthesis of natural products.
- P. D B. mayo: The chemistry of natural products
- P.W. Bently: Chemistry of Natural products,
- I. Final: Organic chemistry vol. II and I
- J.B. Hendrickson The molecules of nature.
- I. Final: Organic chemistry vol. II and I
- J. Sing and J. Sing: Organic Photochemistry

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SEMESTER- 4rth **Subject Code: 4010411105**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Inorganic chemistry (Elective paper-III) **Theory Min. Marks: 28**
Separation Science

Course Objective-To understandthe separation techniques of organic & inorganic compounds.

UNIT-I
Solvent Extraction Separation
Principles of solvent extraction, formation of metal complexes, distribution of extractable species, quantitative treatment of extractable equillibria, Methods of extraction, techniques in extraction, application of diketone, hydroxyquinoline, oximes, dithiocarbamates, xanthets, thiols, macrocyclicpolythenes and Separation of nonmetals and metals.

UNIT-II
Chromatographic separation techniques
Extraction chromatography, theoretical aspects of extraction chromatography, correlation between solvent extraction and extraction chromatography, techniques in extraction chromatography, chromatographic inert support, stationary phases, use of extraction chromatography for separation of fission products.

UNIT-III
Ion exchange separation
Fundamental properties of ion exchangers, theories of ion exchange, exchange capacity, screening effect, penetration of electrolytes into the ion exchange resins, sorption of complex ions, ion exchanges equilibrium, column operation, theory of break through curves, elution steps, use of non aqueous solvents in one exchange separation, application of ion exchange separation removal of interfering ions.

UNIT-IV(10+2)
Separation by electrolysis Basic principles, over potentials, electrogravimetry, constant current electrolysis,separation with controlled electrode potentials, constant voltage electrolysis and physical characteristics of metal deposits, internal electrolysis,electrography, electrophoresis, and electro chromatography.

UNIT-V
Gas Chromatography
Principles of gas chromatography, plate theory of gas chromatography, Instrumentation for gas chromatography, working gas chromatography, Adsorption chromatography, HPLC, gas liquidchromatography , flow programming chromatography, gas-solid chromatography, and hyphenated techniques in chromatography Problems.

Course outcomes-After the completion of course learner should able to understand about

- Solvent extraction and chromatographic seperation.
- Ionexchange separation.
- Gas chromatographic analysis.

Recommended Book

- Solvent extraction in analytical A chemistry by G.H. Morrison, F. Frieiser, john Wiley & Sons, NY.
- Sovent extraction Chemistry, Selkine and alegagawa.
- A.I. Vogel, A Text Book of quantitatice Inorganic Analysis. Longmann Green.
- D.A. Skoog& D.M. west, Fundamentals of Analytical Chemistry- holy Rinchart.
- S.M. Khopkar, Basic Concepts of Analytical Chemistry.

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SEMESTER- 4rth **Subject Code: 4010411107**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Physical chemistry (Elective paper-III) **Theory Min. Marks: 28**
Surface chemistry

Course Objective-To understand the surface phenomena of solid, liquid and gaseous substances.

Unit I

Adsorption and surface phenomenon : Physisorption and chemisorption , adsorption isotherms, Langmuir and B. E. T. equation and significance in surface area determination, surface films, states of insoluble films, L. B. films and their application, adsorption from solution, adsorption types, surface excess concentration , Gibb's adsorption equation : derivation , significance and experimental verification , catalytic activity of surfaces.

Unit II

Micelle : Surface activity, surface active agents and their classification, micellisation, critical micelle concentration (cmc) thermodynamics of micellisation , factors affecting cmc, methods of determination of cmc , reverse micelle , solubisation of water insoluble organic substances , use of surfactants in oil recovery ,

Unit III

Emulsion: Types of emulsion, theories of emulsion and emulsion stability, identification of Emulsion types, inversion emulsion, micro emulsion: theory and application ,

Unit IV

Liquid gas and liquid interfaces: Surface tension, capillary action, methods of determination of surface tension, surface tension across curved surfaces, vapor pressure of droplet (Kelvin equation) , surface spreading , spreading coefficient, cohesion and adhesion energy,contact angle, constant angle hysteresis, wetting and detergency.

Unit V

Solid - Solid interfaces : Surface energy of solids, adhesion and adsorption, sintering and sintering mechanism, Tammann temperature and its importance, surface structure and Surface composition.

Course outcomes-After the completion of course learner should able to understand about

- Adsorption and surface phenomenon.
- Micelle and emulsion.
- Liquid -gas,liquid-liquid &Solid - Solid interfaces..

Recommended Book

- Physical chemistry of surfaces: A.W. Adamson.
- Chemisorptions by B.m.W. Trapnell and H.O. Hayward.
- Introduction to colloide and surface chemistry by D.J. Shaw.
- Theories of chemical reaction rates by A.J.K. laidler
- Surface chemistry by J.J. Bikermann

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SEMESTER- 4rth
Course: M.Sc. Chemistry
SUBJECT: Organic chemistry (Elective paper-IV)
Stereochemistry

Subject Code: 4010411104
Theory Max. Marks: 70
Theory Min. Marks: 28

Course Objective-To study understand the details stereochemistry of organic compounds.

UNIT-I

Stereochemistry of Organic Compounds

Molecular chirality and stereochemical nomenclature.Molecules with chiral axes and planes.Molecular shape, topology and optical activity.Atropisomerism and its designation.Racemisation, resolution, prostereoisomerism, stereotopicity and enantiomeric excess.Non-carbon chiral centres.Introduction to chiroptical properties.

UNIT-II

Newer methods of stereoselective synthesis

Introduction and stereoselective and stereospecific reactions.Enantioselective synthesis (chiral approach) reactions with hydride donors, hydroboration, catalytic hydrogenation via chiral hydrazones and oxazolines.Sharplessepoxidation.Diels Alder selective synthesis, use of calculations of optical purity and enantiomeric excess.

UNIT-III

a)Conformation and reactivity in acyclic compounds and of cyclohexanes
Stability and reactivity of diastereoisomers. Curtin- Hammett principle,
b) Some aspects of the stereochemistry of ring systems
Stereoisomerism and determination of configuration Stability of rings and ease of rings formation)
c) The shapes of the rings other than six membered: Shapes of five, six, and seven membered rings

UNIT-IV

a) Fused and bridged rings: Fused bicyclic ring systems :
Cis and transdecalins and perhydrophenanthrene. Bridged rings, Nomenclature stereoichemical restrictions, and The Bredt's rule, Reactivities.
b) O.R.D. and C.D. : Types of curves, the axial haloketone rule.
The Octant rule.Determination of conformation and configuration.

UNIT-V

a) Stereochemistry of Allenes, Spiranes and Biphenyls
Assignment of configuration
b) Configuration of diastereomers based on physical and chemical methods.

Course outcomes-After the completion of course learner should able to understand about

- Molecular structure and its geometry.
- Stereoselective synthesis
- Conformational and configurationalanalysis of organic compounds

Recommended Book

- E.L. Elil: Stereochemistry of carbon compounds
- D. Nasipuri : Stereochemistry: of organic compounds
- P.S. Kalsi: Stereochemistry: conformation and Mechanism.
- Hallas: Organic stereochemistry
- Mislow and Benjamin: Introduction to stereochemistry.

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SEMESTER- 4rth **Subject Code: 4010411106**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Inorganic chemistry (Elective paper-IV) **Theory Min. Marks: 28**
Organometallic Chemistry

Course Objective :
To Learn about basic terms & Properties of Organometallic & Coordination compounds, and their applications .

UNIT-I
A)Catalytic processes
Introduction definition and classification of organometallic compound Catalysis: Carbonylation, hydrogenation, Hydroformylstion, Metalolifine complex(zeise's salts) , Wilkinson catalysis, polymerization, Wacker process, Monsanto process.
.
B) Carbene: schrock carbine and fischer carbine, The tebbe reagent

UNIT-II
A)Organometallic synthesis
Clasification of ligands: one- carbon bonded ligands, Two-carbon bonded ligands, three-carbon bonded ligands, four-carbon bonded ligands, five- carbon bonded ligands, six-carbon bonded ligand, seven-carbon bonded ligand and eight-carbon bonded ligands

B) Cyclopetadienyl-CP: Ferrocene: preparation, reaction, structure bonding and aromatic character of ferrocene.

UNIT-III
A)Coupling reactions of Organometallic compounds
Heck coupling reaction;application, Suzuki coupling reaction ;Sonogashira coupling reaction; Stille coupling reaction; Kumada coupling reaction:Negishi coupling reaction: Hiyama coupling reaction.
B) Pausonkhand reaction. Beta elimination reaction.Nitrosyl.

UNIT-IV
A)Metal carbonyl: types, preparation, reaction, bonding and spectral property. Metal clusters: properties, classification and procedure to calculate number of m-m bond. Isolobalanlogy and cluster compound
B) Reaction of organometallic compound: Oxidative addition reaction, reductive elimination reaction, migratory insertion reaction and Elimination reaction .

UNIT-V
Techniques of Organometallic Chemistry
A)Fluxionality: structure and bonding. Metal carbonlate. Metal hydride complex.
B) Bonding in organometallic compound: metal carbon ionic bond, metal carbon sigma bond, metal carbon multiple bond. Factors providing stability to metal carbon bond.

Course Outcomes :
To trend about application and various properties of Organometallic Compound.

Recommended Book

- James E. Huheey: Inorganic Chemistry Principles of Structure and reactivity, harber& Row, Publishers Inc. New York 1972.
- F.A. Cotton & R.G. Willkinson: Advanced Inorganic Chem.
- Jones: Elementary Coordination Chemistry J. Weily
- Graddon: Introduction to Coordination Chemistry J. Weily
- Drago: Physical methods of Inorganic Chemistry. J. Weily

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SEMESTER- 4rth **Subject Code: 4010411108**
Course: M.Sc. Chemistry **Theory Max. Marks: 70**
SUBJECT: Physical Chemistry (Elective paper-IV) **Theory Min. Marks: 28**
Chemistry of materials

Course Objective-To understand the solid materials and its nanocomposites.

Unit I

Glasses, Ceramics, Composite and Nanomaterials: Glassy state, glass formers and glass modifiers, applications, Ceramic structures,mechanical properties, clay products. Reformatories,characterizations, properties and applications.Microscopic composites; dispersion - strengthened and particle - reinforced, fibre -reinforced composites, macroscopic composites. Nanocrystline phase, preparationprocedures, special properties, and applications.

Unit II

High TcMaterials: Defect perovskites, high Tc superconductivity in cuprates, preparation andcharacterization of 1-2-3 and 2-1-4 materials, and normal state properties;anisotropy; temperature dependence of electrical resistance; optical photon modes,superconducting state; heat capacity; coherence length, elastic constants, positionlifetimes, microwave absorption - pairing and multigap structure in highTc materials , applications of high Tc materials.

Unit III

Polymeric Materials: Molecular shape , structure and configuration, crystallinity, stress- strain behavior,Thermal behavior, polymer types and their applications, conducting andferro -Electric polymers.

Unit IV

a)Thin films and Langmuir- Blodgett Films: Preparation techniques; evaporation / sputtering, chemical processes, MOCVD, sol - gel etc. Langmuir- Blodgett (LB) film, growth techniques, photolithography, properties and application of thin and LB films.

Unit V

Materials of Solid Devices : Rectifiers, transistors, capacitors IV-V compounds, low dimensional quantum Structure; optical properties.

Course outcomes-After the completion of course learner should able to understand about

- Composite and nanomaterials.
- Polymeric materials
- Materials of Solid Devices.

Recommended Book

- Solid Stte Physics, N.W.Ashcrott and N.D. Merin, Saunders College.
- Material Science and Engineering, An introducation, W.D.Callister, Willey.
- Principals of Solid State, H.V.Keer Willey Eastron.
- Materials Science, J.C.Andterson, K.D.Leaver, J.M.Alexander and R.D.Rawlings, ELBS.
- Thermotropic Liquid Crystals, Ed, G.W.Gray, John Willey.
- Text Book of liquid cristals, kelkar and Halz, Chemie.

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SEMESTER- 4th | **Subject Code: 4010411102**
Course: M.Sc. Chemistry | **Theory Max. Marks: 100**
SUBJECT: LAB GENERAL-II | **Theory Min. Marks: 50**

Course Objectives- Determination of various samples by chemical analysis using different methods of volumetric, instrumental, Spectroscopic, classical and Chromatographic techniques along with their applications.

1. CLASSICAL

- Determination of Organic Nitrogen.
- Determine the saponification value of given oil sample.
- Determination of Iodine Value in given oil sample.
- Determination of E_a of saponification of ester by conductometry method.
- Determination of Moisture content in given sample.
- Determination of adsorption isotherm of of the given sample from aqueous solution by using activated charcoal.
- Determination of dissociation constant of an acid - base indicator.

2. INSTRUMENTAL

a) Spectrophotometric/ Colorimetric determination
   Determination of nitrate, sulphide, Phosphate, Chromium and copper
b) Determination of Manganese in steel
c) Flame photometry/ AAS:
   - Determination of sodium, potassium and calcium
   - Determination of potassium in combined fertilizer
   - Determination of calcium in wine
   - Simultaneous determination of sodium and potassium in soil samples
   - Determination of Arsenic in water samples

3. Chromatography: Advanced chromatographic separations of the given sample

4. Experiments based on: UV - Visible spectroscopy with application, Fluorescence Spectroscopy with application, Infrared Spectroscopy, Ion selective electrodes, Semiconductor materials, Optical materials.

5. Table work: Data Analysis, error analysis, least squares method, Characterization of sample using IR spectroscopy, Mass and NMR spectroscopy.

Course Outcomes-After the completion of course learner should able to understand about

- Qualitative Analysis (Titriometric)
- Colorimetric analysis
- Chromatography techniques.
- Modern Instrumental techniques.

Text book:

- Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
- Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
- Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
- Experimental Physical Chemistry R.C. Das and Beher, Tata McGraw Hill.
- Analytical Chemistry,Alka L. Gupta, Pragati Publication, 5th ed.
- Advanced Inorganic Chemistry, S.K. Agarwala and KeemtiLal, 12thed.

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SEMESTER- 4rth
Course: M.Sc. Chemistry
SUBJECT: Project Work

Subject Code: 4010431101
Practical Max. Marks: 300
Practical Max. Marks: 150

PROJECT

All the candidates of M.Sc.(Chemistry) are required to submit a project-report based on the work done by him/her during the project period. A detailed Viva shall be conducted by an external examiner based on the project report. Students are advised to see the detailed project related guidelines on the website of CVRU. (www.cvru.ac.in) under Project Guidelines for student section.