APPENDIX – AE26

MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI – 12
DIRECTORATE OF DISTANCE AND CONTINUING EDUCATION
M.Sc. CHEMISTRY
(Effective from the Academic Year 2016-2017 onwards)
SCHEME OF EXAMINATION

1. Name of the Course:

M.Sc Branch IV (C) Chemistry , Non- Semester conducted by the Directorateof distance Education (DDE), M.S. University, Tirunelveli- 627 012

2. Duration

Two years non semester pattern with examination at the end of I and II years.

3. Eligibility for Admission

   Candidates who have passed the B.Sc chemistry (Main) Degree examination of any University of India, approved by UGC.

4. Contact Seminars and Practicals:

   Contact Seminars and practicals will be conducted by the DDE of M.S. University, Tirunelveli – 627 012.

5. Medium of Instruction : English

(b) Practicals

Distribution However, there on of marks: Same as above

Practical paper II Inorganic Chemistry Practical 6 hrs 150

11. Practical paper III physical Chemistry Practical 6 hrs. 150

Total marks for both I & II years 1250

Title of the paper	Credits
Paper – 1 Organic Chemistry - I	6
Paper – 2 Inorganic Chemistry – I	6
Paper – 3 Physical Chemistry – I	6
Paper – 4 Environmental Chemistry	6
Paper – 5 Practical I – Organic Chemistry	6
Paper – 6 Organic Chemistry – II	6
Paper – 7 Inorganic Chemistry –II	6
Paper – 8 Physical Chemistry – II	6
Paper – 9 Bio-organic, Bio-inorganic and Bio- Physical Chemistry	6
Paper – 10 Practical II – Inorganic Chemistry	6
Paper – 11 Practical III – Physical Chemistry	6
Total No. of Credits	**66**

FIRST YEAR
PAPER I : ORGANIC CHEMISTRY – I

Unit –I

Mechanism of electron displacement in organic molecules:

Effect of structure in the dissociation constant of acids and bases-EDA complexes – Crown ether complexes – Inclusion compounds. Quantitive treatment of the effect of structure on resetivity the Hammett relationship – significance of reaction and substituent constants – application of the Hammett equation – Limitations and deviations. Introduction to reactions mechanism- reactive intermediates – free radicals – carbine – nitrenes – carbanions – carbocations – Formation and stability of these species.

Aromatic electophilic disubstitution –partial rate factors.

Kinetic and non- kinetic methods of determining organic reaction mechanism.

Unit – II

Sterechemistry

Study of symmetry of molecules – as symmetric and disyymmetric molecules-concept of chirality and optical isomerism-molecules with more than one chiral centre-Axial chirality in allenas, biphenyls and spiranes.

R.S. – notation of the above molecules, stereospecificity and steroselectivity, asymmetric synthesis – Cram's rule – Prelog's rule.

E/.Z – nomenclature of geometrical isomers.

Conformational Analysis:

Conformations of cyclic systems up to six – membered rings – Conformational analysis of mono and disubstituted cyclohexanes – Effect of conformation of decalins – prehydro phenanthrenes.

Unit III

Alkaloids: Structure, synthesis and stereochemistry of the following alkaloids. Quinine, Norphine, Lysergic acid and Tylophorine – Biosynthesis of alkaloids.

Antibiotics:

Structure and synthesis of the following : chloramphenicol, cephalosporin , C. penicillin, streptomycin and Tetracyclin.

Unit IV

Aromaticity:

Benzenoid and non- benezenoid aromatic compounds. Huckel's rule concept of homo aromaucity and anti aromaticity – systems with 2,4,6,8 and 10 electrons. Annulenes – fulvene, azulene, and tropolones.

Heterocyclic Compounds:
Synthesis and reactions of sydnones, carbazole and imidafole – structure elucidation of flavones, quercetin, cyanin, caffeine, theobromine and theophylline.

Unit V

Aliphatic and aromatic nucleophilic substitution
SNI and SN2 mechanisms – effect of substrate structure, base solvent and the leaving group and the solvent on nucleophilic substitution –symphoria – NGP due to n and electrons SN1, SN2, SNi, SNi; mechanism
Eliminations:
E1, E2, and E1CB mechanisms – effect of the substrate structure, base solvent and the leaving group on elimination- Hofmann, Saytzeff and Bredt's rules.
Aromatic nucleophilic substitution –Benzyne mechanism – Von Richter rearrangement.
Mechanism of addition to multiple bonds:
Stereochemical factors in the addition of the following to carbon –carbon double bonds- hydrogen , hydrogen halide – hydroboration – hydroxylation.
Mechanism of Mannich reation, claisen ester condensation, Dieckman n condensation, Stobbe condensation Darzen's reaction, Refomatsky reaction, Wittig and Grignard reactions – Stork's enamine reaction – Michael addition.

References

Unit I

1. The Modern Structural Theory of Organic chemistry
   L.N. Fergusar – Prentice Hall.
2. Mechanism and Structure in Organic Chemistry
   E.S. Gould – Henry Holt & Co.
3. Mechanism and Theory in Organic chemistry
   T.H. Lowry and K.S. Richardson.
4. Organic chemistry – S.Pine
   Mc. Gaw Hill, Kogakusha Ltd.,
4. Advanced Organic chemistry – Jerry March, J. Wiley
5. Organic chemistry – R.T. Morrisonand Boyd, Prentice Hall
6. A Guide book to Mechanism in Organic chemistry – P. Sykes – orient Longman.
7. Organic Chemistry Vol. I.I.L. Finar , ELBs.
8. Fundamentals of Organic Reaction Mechanism- J.M. Harris and C.c. Warnser – John Wiley & Sons
9. Reaction Mechanism in Organic Chemistry – Bansal
10. Advanced Organic Chemistry – Part – A- F.A. Carey and R.J. Sundberg.
11. Correlation Analysis in Organic Chemistry – J. Shorter – Clarendress, Press, Oxford.

Unit II

1. Stereochemistry of Carbon Compounds – E.L. Eliel, Mc. Graw Hill.

2. Introduction to Stereochemistry – K. Mislow – Benjamin.
3. Stereochemistry-V.M. Photapov-MIR publishers.
4. Stereochemistry of Organic Compounds – Principles & Applications, D. Nasipuri Wiley – Eastern Ltd.
5. Stereochemistry – Conformation and Mechanism – R.S. Kalsi-Wiley Eastern.
6. Organic Chemistry – Vol II – ELBS.

Unit – III

1. The Alkaloids-Bentley-Inter Science Publishers.
2. Chemistry of Alkaloids – Pelletier
3. The Chemistry of Organic Natural Products – O.P. Agarwal – goel publishing House.
4. Organic chemistry Vol II – I.L. Finar, ELBs.
5. Monograph series as "The Alkaloids"
6. Medicinal Chemistry – A. Burges – Academic Press.

Unit –IV

1. Aromatic Character and Aromaticity – G.M. Badger – Cambridge
2. Aromaticity – S.J. Garelt – Mc. Graw Hill.
3. Advanced Organic chemistry – J. March, Wiley.
4. Organic Chemistry Vol.I & II – finar ELBS.
5. Chemistry of Heterocyclic compounds – R.M. Acheson- Wiley Eastern.
6. The Chemistry of organic Natural products – O.P. Agarwal – Goel publishing House.

Unit – V

1. The Mechanism and Theory in Organic chemistry-T.H. Lowry and K.S. Richardson.
2. Advanced Organic Chemistry –J. March, Wiley
3. Mechanisms and Structure in Organic chemistry. – E.S. Gould – Henry Holt & Co, New York.
4. Fundamentals of Organic Reaction Mechanisms – J.M. Harris and C. Warnser – John wiley & Sons.
5. A Guide Book to Mechanism in Organic Chemistry – P. Sykes – Orient Longman.
6. Reaction Mechanism in Organic Chemistry – Bansal
7. Organic Chemistry – R.T. Morrison & R.N. Boyd
8. Stereochemistry of Carbon Compounds – E.L. Eliel – Mc Graw Hill.
9. Organic Chemistry Vol. II – I.L. Finar
10. Advanced Organic Chemistry – Part A- F.A. Corey and R.J. Sundberg – Plemum press.

PAPER II: INORGANIC CHEMISTRY I

Unit I

Bonding and Sterochemistry

Electronic configuration of elements – significanc of quantum numbers – polyelectron atom – pauli's principle – Aufbau principle – qualitative treatment of VB and MO theory – α and π

bonds – hybridaion and resonance – applications of VB and MO theory- the electron deficient molecule – boronhydrides and metal alkyis.

Bond order – Bond energy – bond length – bond polarity – partial lonic character- electronegativity and different scales of Pauling scale – periodicity of electronegativity, electron affinity and ionic radius – lattice energy- Born Haber cycle and numerical problems involving it for the calculation of electron affinity or lattice energy-covalent character in ionic compounds – different types of electrostatic interaction, hydrogen bonding.

Sterochemistry, VSEPR, Walsh diagrams (tri and penta atomic molecules) $^{d}\pi$-$^{P}\pi$ bonds Bont's rule and energetic of hybridization – uses of Bents rule – "apicophilicity".

Unit II

Solid State Chemistry

Elements of crystallography – space lattices – Unit cells – crystal systems – X-ray diffraction, Bragg's equation – Bragg's method – rotating method and powder method of X-ray diffraction- structure of typical lattices such as calcite, Zinc blende, Wurtzite, rutile Fluorite, Antifluorite, pervoskite.

Crystal defects in solids – line and plane defects - non stoichiometry – schottky and Frenkel defects and colour centres; solid electrolytes.

Free electron and band theory – semiconductors – types and properties of semiconductors – Hall effect – photovoltaice and solar energy conversion – superconductivity – high temperature super conductors- cooper electrons – Meissenner effect and levitation.

Unit III

Nuclear Chemistry

Radioactivity and modes of decay – α, β, and γ Different types of nuclear reactions with natural and artificial particles – Q value, cross section, spallation, fission and fusion. Charateristic of fission reactions, product distribution and for fission, of liquid drop model, fissile and fertile isotopes; nuclear fusion and stellar energy. Transmutation of elements and chemical effect on transmutation, Isotopes and their applications. Radioactive analysis and counting techniques Geiger – Muller, Ionisation, proportional and Scintillation counters)

Radioanalytical Methods:

Neutron activation analysis – Isotopic dilution methods – Radiometric titrations.

Unit IV

Coordination Chemistry and Magnetism Bonding in Coordination Compound

Nature of metal – ligand bond: VB theory – electroneutrality principle and back bonding – crystal field effects for octahedral, tetragonal, square planar and tetrahedral symmetries, applications of CFT- Site preferences; spectrochemical series and nephelauxetic effect; MO theory for octahedral complexes – pi bonding and MoT – Static and dynamic Jahn – teller behaviour.

Magnetic behaviour- dia, para, ferro, ferri and antiferro magnetisms; magnetic moment determination by Guoy and Faraday methods; Spin only value and its deviation- Quenching of orbital angular momenta and spin – orbit coupling. Determination of geometry of Co and Ni complexex from magnetic data. Spin Crossover phenomenon; magnetic properties of lanthanides and actinides.

Unit V

Metallurgy and Inorganic Polymers

Occurance, isolation, purification, properties and uses of the following metals and their important compounds: Zr, Ge, Pu, Th, U and Os.

Silicates:

Various silicate structure – property correlation – silicones – polyacids – structure of heteropoly and isopolyacids – polymeric sulphur nitride – borazines- phosphonitrilic compounds – boranes and carboranes.

References:

1. Jame E. Huheey, Inorganic Chemistry: Principle of structure and Reactivity (Harper Collins)
2. K.F. Parcel and J.C. Kotz, Advanced Inorganic chemistry (Saunders Golden).
3. G.C. Demitrass et. All , Inorganic Chemistry (Prentice Hall)
4. B.E. Douglas, D.H. Mc. Daniel and J.J. Alexander , concepts and models of Inorganic chemistry.
5. H.J. Emeleusand A.G. Sharpe, Modern Aspects of Inorganic Chemistry, ELBS.
6. M.C. Day Jr. and J. Selbin, Theoretical Inorganic Chemistry, East West Press.
7. F.A. Cotton and Wilkinson, Advanced Inorganic chemistry, john wiley.
8. N.N. Greenwood and A. Earnshow, Chemistry of Elements, Pergamon
9. L.Araroff, Introduction to Solids, Tata Mc Graw-Hill
10. C. Kittel, Introduction to solid State physics, Wiley Eastern
11. A.F. Wells, structural Inorganic Chemistry, ELBs.
12. M.v. Keer, Principles of the solid state, Wiley Eastern
13. A.R. West, Solid State Chemistry and applications, plenom.
14. D.K. Chakrabarthy, Solid State chemistry Ne Age International.
15. S. Glasstone, Source Book on Atomic energy, East west Press.
16. H.J. Arniker, Essential of Nuclear Chemistry, Wiley Eastern.
17. G. Fridlander, J.W. Kennedy E.S. Macias and J.M. Miller. Nuclear and Radiochemitry, John Wiley and Sons.

PAPER III : PHYSICAL CHEMISTRY I

Unit : I

Thermodynamics

Thermodynamics of systems of variable composition. Partial Molar quantities, a partial Molor volume. Experimental determination, chemical potential, Gibbs Duhem equation- Thermodynamic properties of real gases- Fugacity, determination of fugacity of real gases. The concept of activity for condensed states. Thermodynamic equation of states – derivation and application. Maxwell's thermodynamic relations.

Thermodynamic properties at absolute Zero.

De Dondee treatment of chemical equilibrium – non equilibrium thermodynamics, entropy production, onsager reciprocal relationship.

Three component systems- partially miscible three liquid systems, formation of one pair, two pairs and three pairs of partially miscible liquids. Systems composed of two solids and a liquid. Gystallisation of pure component only, formation of solid solution and partial miscibility of solid phases.

Unit II

Quantum Mechanics- I

Postulates of quantum ,mechanics. Schrodinger time independent equation Wave function operators-linear and hermitian operator, method of setting up quantum, mechanical operators. Eigen function and Eigen values. Degeneracy, Orthogonality and normalization of wave function. Commuting and non- commuting operators. Non- commuting operators and uncertainity principle.

Application of quantum mechanics of simple system – free particle, particle in ID Box, particle in 3D (cubic box and rectangular) Box, simple harmonic oscillator rigid rotator and hydrogen atom.

Unit III

Quantum Mechanics III

Approximation method – perturbation theory (first order only0 and variation method secular equaltion and secular determinants. Helium atom and effective nuclear charge. Electron spin and Paul is principle. Slater determinant, Born – Oppenheimer approximation. Hatree Fock Self consistent field method of many electron systems.

LCAO approximation. MO method for H_2^+ and H_2. VB treatment of hydrogen molecule. Hybridisation. Huckel theory of conjucated systems, bond order and charge density calculation, Application to ethylene and butadiene.

Unit IV

Statistical Thermodynamics

Aim of statistical thermodynamics. Boltzman distribution law and its derivation. Partition function. Derivation of expression for translational, rotational and vibrational partition function. Thermodynamic properties from partition function. Quantum Statists – Fermi Dirne and Bose – Einstein statistics. Population inversion. Negative Kelvin termperature- Ensembles. Einstein and Debye theories of heat capacities of solids.

Unit V

Electrochemistry

Debye- Hucket theory of ion interaction, derivation and experimental verification. Activity co-efficient Debye Huckel Limiting law. Modification of Debye Huckel Limiting law. Kinetics of electrode processes- Butler – volmer equation Tafel curves Electical double layer – zeta potential – electrokinetic phenomena.

Vollammetry and polarography – current – voltage relationships, dropping mercury electrode, half wave potential , Applications of polargraphy. Coulometry, primary and secondary coulometric analysis, anperometric titrations, chronopotentiometry cyclic voltammetry. Electrochemical energy conversion storage and fuel cells, Thermodynamics of fuel cells.

Reference

1. S. Glasstone – Thermodynamics for chemists
2. S. Glasstone – An introduction to electrochemistry
3. B. Viswanathan etal Eletrochemistry
4. D.R. Crow , Principle and Applications of electrochemistry
5. L. Antropov, Theoretical electrochemistry
6. A.K. Chandra, Introductory quantum chemistry
7. J. Rajaram and J. Kuriacose, chemical Thermodynamics.
8. JN Levine, Quantum Chemistry.

I Year

Paper IV Environmental Chemistry

Unit I

Environment and Ecosystem

Introduction to Environmental chemistry its concept and scope environmental segments – atmosphere, hydrosphere, lithosphere and biosphere. Environment and ecosystem; biogeochemical cycles of water and elements C, N, O, S and p.

Unit II

Atmosphere and air pollution

Evolution, chemical composition and structure of atmosphere. Chemical and photochemical reactions in atmosphere- oxides of S,N and C and their effect; green house gases and global warning, photochemical smog, acid rain and ozone hole formations. EI Nino phenomenon; partilates and radio activity in atmosphere. Analysis and control of air pollutants. Air pollution episodes- TCDD, Bhopal and Chernobyl disasters.

Unit III

Hydrosphere and water pollution

Various water resources and their characteristics; water pollution – source and classification; organic inorganic and radioactive pollutants; sampling and analysis of water pollutants; water quality parameters and standards; determination of water quality parameters. Fluorosis and defluoridation; water treatment processes and preservation. Some case studies of water pollution.

Unit IV

Lithosphere and soil pollution

Chemical composition; micro and macro nutrients in soil; pollution by fertilizers, persticides, plastics and heavy metal compounds. Plant as indication of soil pollution; treatment and abatement procedures for soil pollution.

Natural resources – Mineral resources – metals and non-metals ; fuel and energy resources – coal , petroleum, natural gas, solar energy, hydrogen from water eleavage and tidal and wind energy. Natural organic and inorganic vermicompost fertilizers. Biofertilisers blue – green algae, rhizobium, azospirillum and phosphobacteria.

Unit V

Environmental Restoration

Environmental resotation – waste disposal and their management by chemical and biological methods, recycling and further use of waste; conservation of forests and wild life.

The state of global environment and earth summit. India's effort in environmental protection – the environment act 1986 and its amendment; participation of voluntary agencies in environmental protection.

References:

1. A.K. De, Environmental Chemistry, New Age Publishers, New Delhi, 3rd edn. 3rd reprint 1996.
2. B.K. Sharma and H. Kaur, Environmental Chemistry, Goel Publishing House, Meerut, 3rd edn. 1996-97.
3. G.S. Sodhi, Environmental Chemistry, Narosa Publishing House, New Delhi, 2000.
4. C. Baird, Environmental Chemistry, W.H. Freeman and Company, New York 1995.

5. E.P. Odum, Fundamentals of Ecology, W.B. Saunders publications.
6. S.S. Dara, A textbook of environmental Chemistry and Pollution Control, S. Chand & Company, New Delhi.

II YEAR
PAPER V ORGANIC CHEMISTRY – II

Unit – I

UV, IR & Mass spectroscopy:

Absorption spectra of conjugated dienes & α, β-unsaturated carbonyl compounds – woodward - fieser rules – spectra of aromatic and heterocyclic compounds – Scott's rule – solvent effects.

Vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, amines, acids, esters& amides.

Effect of hydrogen bonding & solvent effects on absorption frequencies – Fermi resonance.

Molecular ion peak – Base peak- metastable peak – nitrogen rule – Mc, Lafferty rearrangement – isotopic peaks- fragmentation pattern of organic compounds.

Unit II

^{1}H-NMR, ^{13}C- NMR, ORD & CD

^{1}HNMR – principle of NMR – Chemical shift – spin – spin coupling, delta & tall values of aliphatic, olefinic – aldehydic, aromatic, carboxylic, enolic, phenolic, alcoholic protons.

Chemical exchange – deuteration – simplication of complex spectra – double resonance – shift reagents.

^{13}CNMR – chemical shift & coupling constants of aliphatic, aromatic & carbonyl carbons.

ORD & CD – Principle – Types of ORD curves- α, haloketone rule – octant rule – applications of these in the determination of configuration & conformation of simple monocyclic & bicycle ketones.

Unit III Terpenes.

Structure and Synthesis of α, pinene , zingiberene, r- bisabolene α , --santonine, abietic acid – Biosynthesis of alkaloids.

Steroids

Classification – structure elucidation of cholesterol – synthesis of ergosterol androsterone, testosterone, estrone & progesterone – Bile acids.

Prostoglandins:
General study – structure & synthesis of PGE1 & PGF 1

Vitamins:
Vitamin A1, B1, B2, B6, C, D & E

Unit IV

Thermal & Photochemical reactions – allowed & forbidden transitions- Jablonski diaglran, photochemical reactions of metones- photosensitisation – Norrish Type I & II reactions – Paterno- Bucho reaction.

Pericyclic reactions – conservation of orbital symmetry – electrocyclic reactions- cycloaddition reactions and sigmatropic rearrangements – Applications of correlation diagram approach, Huekel – Mobius approach to the above reactions.

Molecular Rearrangement:

Migratory aptitude of groups – Mechanisms of the following rearrangements – Wagner – Meerwin , Demjanov, Baeyer Villiger oxidation – Favorski, dienone – phenol, di - π- methane , Stevens, Sommelet- Hauser, Free radicals Stability of free radicals. Barton Ullmann, Hunsdiecker, Hofmann – Lofler – Freytag reactions.

Unit V

Reagents in Organic Synthesis

Use of the following reagents in organic synthesis – complex metal hydrides – lithium dimethyl cuprate, lithium di-isopropylamide, DCC, Trimethyl silyl Iodide, DDQ, SeO_2 Peternon's synthesis.

Organiometallic reagents methyl lithium, aluminium tertiary butoxide, aluminium isopropoxide.

Planning Synthesis:

Synthon – synthetic equivalent- Relay, linear & Convergent synthesis – functional group interconversions – use of activating & blocking groups – stereoselective problems of geometrical & optical isomerism – retrosynthetic analysis of γ Bisabolene & cis – Jasmone.

Transition metal complexes in organic chemistry – homogeneous hydrogenation – diastereo selectivity enantioselectivity.

References:

Unit I & II

1. Application of Absorption Spectroscopy- J.R. Dyer, Prentice Hall.
2. Organic spectroscopy – W. Kemp – Palgrave third Edition
3. Spectrometric Identification of Organic compounds – S.M. Silverstein, G.V. Bassler and T.C. Morril – Wiley.
4. Interpretation of Carbon – 13 Spectra – f.W. Whirli and t. Wirthilin.

5. Organic Spectroscopy – V.R. Dani – Tata Mc Graw Hill Publishing Company Ltd.
6. Spectroscopic Methods in Organic chemistry – D.H. Williams and Ian Fleming, Tata Mc. Graw Hill.
7. Elementary Organic Spectroscipic Principles and chemical Applications. – Y.R. Sharma – S. Chand & Co.
8. Organic Spectroscopy – Principles and Applications. – Jag Mohan – Narosha Publishing House.
9. Stereo Chemistry of Carbon Compounds – E.L. Eliel – Mc- Graw Hill
10. Mass spectrometry – Principles and applications- I, Howe , D.H. Williams and R.D. Bowen – Mc Graw Hill
11. Organic chemistry – vol –II – I.L. finar , ELBs.
12. ORD and CD in Chemistry and Biochemistry – academic Press.

Unit – III

1. Organic chemistry Vol. II – I.L. finar – ELBs
2. Chemistry of Terpenoids – Paul de Mayo – Vol I & II – Academic Press.
3. The Chemistry of Organic Natural Products – O.P.Agarwal – Goel Publishing House.
4. Steroids – L. fieser and Mary Fieser – Reinhold.
5. Steroids – Shoppe
6. The chemistry of Steroids – W. Klyne – Methuen and Co, New york.
7. The Prostoglandins Vol I- Ramwell – Plenum Press
8. Principles of Organic Synthesis – R.O.C. Norman
9. The Chemistry of Vitamins – S.F. Dyke – Interscience
10. Medicinal chemistry – A. Burger- academic Press.

Unit IV

1. Organic Photochemistry – J.M. Coxton- B. Halton- Cambridge University press.
2. Organic Chemistry – R.T. Morrison and – R.n. Boyd – Prentice Hall.
3. Organic chemistry – H.Pine – Mc Graw Hill
4. Molecular Reactions & Photochemistry- C.H. Depuy & O.L. Chapman – Prentice Hall
5. Reaction Mechanism in Organic Chemistry S.M. Mukherji & S.P.Singh
6. Pericyclic Reactions, Mukherji & Singh.
7. the Conservation of Orbital Symmetry – r.B. wood ward & Hofmann. – verlog chemic Gmbh & Academic Press.
8. The Importance of Antibonding orbitals – H.H. Jaffe & M. Orchin. – Oxford & IBH.
9. An Introduction to conservation of Orbital symmetry. A.J. Bellamy – Longman.
10. Aspect of Organic Photochemistry- William M. Horsepool - Academic Press – London.
11. Advanced Organic Chemistry – J. March – Wiley.
12. A guide book to Mechanism in organic chemistry – Peter sykes – Orient Longman.
13. Mechanism & structure in organic chemistry – E.S. Gould – Henry Holt & Co.,
14. Reaction mechanism & structure in organic chemistry – Gurdeep R. Chatwal. Himalaya Publishing House.
15. Organic chemistry Vol.II. I.L. Finar ELBs
16. Molecular Rearrangements P.De Mayo.
17. Organic Reactions and Reagents – J.N. Gurtu, R. Kapoor. – S. chand & Co. (P) Ltd.

18. Name Reactions & Mechanism (Vol I & II)- J.N. Furtu, S. G. Rastogi and S.K. Agarwall – Pragati Praskashan.

Unit : V

1. Advanced Organic chemistry
2. Reaction Mechanism and Reagents in Organic Chemistry Gurdeep R- Chatwal. – Himalaya Publishing House.
3. Organometallics in Organic synthesis – J.M. Swan & D. St. C. Black. – Chapman & Hill Text – Book series.
4. Organometallic chemistry – Gurdeep Chatwall, Y. Yadav. – Himalaya Publishing House.
5. Principles of Organic synthesis – R.O.C. Norman Chapman & Hill, London.
6. Some Modern Methods of Organic synthesis W. Curruthers – Cambridge, University Press.
7. Advanced Organic chemistry – part B, F.A. Carrey & R.J. Sundberg.
8. A Programmed Synthon Approach – S. Warren – John Wiley & Sons.
9. Organic Synthesis – R.E. Ireland. – Prentice Hall of India (P) Ltd.
10. Organic chemistry , R.T. Morrison & R.N. Royd – Prentice Hall.
11. Guide Book to Organic Synthesis – R.K. Malkie & D.M. Smith – ELBs – Longman.
12. Organic Synthesis – Michael B. Smith, Mc. Graw Hill, Internaltional Edition.

PAPER VI - INORGANIC CHEMISTRY II

Unit I

Coordination Chemistry – Stability and Reactions

Stability and instability of complexes – determination of stability constants by potentiometric and spectrophotometric methods , factors affecting stability, chelate and template effects. HSAB concept and symbiosis; theroretical basis of softness and hardness; stabilization of unusual oxidation states.

Kinetic stability – lability and inertness, Ligand substitution reactions of square planar complexes – factors affecting reactivity of square planar complexes; the trans effect and its theories and utilization in synthesis of complexes. Substitution reaction in octahedral complexes – acid hydrolysis, base hydrolysis and anation reactions.

Electron transfer reactions – complementary and non-complementary reactions. Inner sphere and outer sphere processes; outer sphere process in photochemical reactions.

Unit II

Spectral Methods I

Electronic spectroscopy L.S. coupling and j-j coupling schemes, microstates, Hund’s rules and Term symbols; selection rules for electronic transition and hole formalism; Orgel and Tanabe – Sugano diagrams; evaluation of 10 Dq and B for Octahedral d 2 and d8 systems. Charge transfer spectra; electronic spectra of lanthanide and actinide complexes.

Optical isomerism in octahedral chelate complexes, their absolute configuration determination from ORD and CD methods; Information on stereochemistry and conformation of chelate complexes.

Unit III

Spectral Methods II

Mossbauer spectroscopy: Principles – isomer shift, quadrupole and magnetic interactions – MB spectroscopy of octahedral high and dlow spins Fe(II) complexs. Information on oxidation state, pi-back coordination and structure in iron compounds. Studies on halides of tin (II) and tin (IV).

NMR : application of Chemical shift and spin-spin coupling to structure determination using multiprobe NMR (^{1}H, ^{31}P, ^{19}F, ^{15}N); effect of quadrupolar nuclei on NMR spectra. NMR studies on Chemical exchange and dynamic processes in inorganic and organometallic compounds. NMR studies on fluxional molecules. Paramagnetic NMR and contact shifts: lanthanide shift reagents.

EPR:

Application of hyperfine splitting and g-factor to structure determination zero field splitting and kramer's degeneracy. Covalency of M-L bonding by EPR study. Application of EPR in the study of J.T. distortion in Cu (II) complexes.

Unit IV

Instrumental aspects not required

Spectroanalytical techniques: Principle and application of colourimetry, spectrophotometry and fluorimetry. Flame photometry techniques: atomc absorption, atomic emission and atomic fluorescence spectroscopy. Light scattering techniques: nephelometry and trubidimetry.

Thermoanalytical techniques: TGA, DTA and DSC methods. Electroanalytical techniques. Electrochemical cell and electrode potentials; electrochemical series and application of redox potential to inorganic reaction systems.

Classification into constant current and controlled potential techniques. Voltammetry, cyclic voltammetry and stripping Voltammetry; amperometry and chronopotentiometry; potentiometry and ion- selective electrodes (halide and alkali ions).

Principle and operation of column, thin-layer and gas chromatographic methods. HPLC and HPTLC; application to inorganic substances. Principle and Application of ion-exchange and solvent extraction methods.

Unit V

Organometallic Chemistry

Introduction, EAN rule and its correlation to stability. Metal carbonyls – synthesis, properties,structure and bonding and isolobal analogy. IR study of metal carbonyls. M-Pi acid complexes – preparation, properties and structural features of complexes with alkene, alkyne, allyl and arena systems. Metalloceness – synthesis, properties, and bonding structure, inferrocene; covalent versus ionic bonding in beryllocene.

Substitution reactions of carbonyls: oxidative additional and reductive elimination, insertion and elimination reactions; nucleophilic and electrophilic attack of coordinated ligands.

Homogeneous catalsis: alkene hydrogenation and synthesis gas; hydroformylation carboxylation of alcohols and oxygenation of olefins.

Heterogeneous catalysis: Fischer Tropsch process, Ziegler – Natta polymerization.

References:

1. D.F. Shriver, P.W. Atkins and C.H. Longford, Inorganic chemistry, Oxford 1990.
2. W.L. Jolly, Modern Inorganic Chemistry, Mc Graw Hill company, 2nd Edn, 1991.
3. J.E. Huheej, E.A. Keiter and R.L. Keiter, Inorganic chemistry, Harper and Row/ Pearson Asia, 2,3 & 4th Edn, 1993.
4. F.A. Cotton and G. Wilkinson, Advanced Inorganic chemistry, John Wiley and Sons,3,4 & 5th edn, 1993.
5. B.E. Douglas, D.H. Mc Daniel andd J.J. Alexander concepts and Models of Inorganic Chemistry, John Wiley & Sons, 2 Edn, 1983 and 3 1994.
6. R.S. Drago, Physical Methods in Chemistry, W.B. Saunders, 1977.
7. E.A. V. Ebsworth et al, structural methods in Inorganic Chemistry, ElBS, 1987.
8. H.H.Willard, L.L. Merritt, J.A. Dean and F.A Settle, Instrumental methods of Analysis 6th ed. CBS publishers 1986.
9. Vogel's textbook of Quantitative chemical analysis. Revised by G.H. Jeffery, J. Bassett, J. Mendhan and R.C. Denney ELBS 5th ed, 1986.
10. D.A. Skoog and D.M. West, Principles of Instrumental Analysis, Holt- Saunders, 2 edn 1980.
11. D.A. Skoog and J.J. Leary, Instrumental analysis, Saunders college publishing 1992.

PAPER VII: PHYSICAL CHEMISTRY – II

Unit I

Chemical Kinetics

Simple collision theory, absolute reaction rate theory (ARRT), thermodynamic treatment, potential energy surfaces, applications of ARRT to Simple biobimolecular Processes; chain reactions – general characteristics, study of kinetics of chain reactions like H2 – Br2 reactions,

decomposition of acetaldehyde and H_20_4 study of H_2 – O_2 explosive reactions. Theory of unimolecular reactions – Lindemann, Hinshelwood, RRKM and Stator treatments; Steady state approximations, principles of microscopic reversibility and detailed balancing, kinetic isotope effect; Reactions in solution, factors influencing reaction rate in solution, ARRT to reactions in solution, significance of volume of activation, primary and secondary salt effects.

Homogeneous catalysis, acid – Base catalysis, acidity function, Bronsted catalysis law. Fast reaction techniques – chemical relaxation methods, temperature and pressure jump methods, ultrasonic absorption technique, reactions in flow system, continuous and stopped flow shock wave tube methods, chemical kinetics in crossed molecular Beam.

Unit II

Photochemistry and Radiation Chemistry

Physical properties of the electronically excited molecules – Excited state dipolemoments, excited State Pka, excited state redox potentials. Photophysical processes in electronically excited molecules – fluorescence, phosphorescene and other deactivating processes, Stern – volmer equation and its applications,electronic energy transfer mechanisms, photosensitization and chemiluminescenc. Experimental techniques in photochemistry-light sources, chemical actinometry, conventional photolysis procedure flash photolysis techniques. Study of photochemical reactions like H_2-X_2 decomposition of photosynthesis, photochemical conversion and storage of Solar energy.

Radiation Chemistry – source of high energy, interaction of high energy radiation with matter, radiolysis of water , definition of G-value, mode of reactions of hydrated electrons, OH and H-experimental techniques on radiation chemistry, dosimetry. Elementary aspects of radiation chemistry in biology and industry.

Unit III

Group Theory

Group Theory: Molecular symmetry elements and symmetry operations, vector and matrix algebra, symmetry operations and transformation matrices; group theory – definition and properties of a group symmetry. Point groups, representation of a group-reducible and irreducible representations, great orthogonality theorem, characters, construction of character, tables, direct product groups.

Symmetry of Normal modes of vibrations, applications of group theory to normal mode analysis, symmetry properties of integrals , application for spectral selection rules of vibrational Spectra-IR and Raman active fundamentals, symmetry of molecular orbitals and symmetry selection rule for electronic transitions in simple molecules (ethylene, formaldehyde, benzene and

naphthaiene), Group theory and quantum mechanics wave function as a basis of irreducible representations, group theory as applied to hybridization, HMO theory and HMO calculation and delocalisatiton energy for ethylene, cyclopropenyl and butadiene systems.

Unit IV

Spectroscopy I

Elements of molecular spectroscopy: Absorption and emission of radiation, the time dependent schrodinger equation, interaction of EMR with matter, Einstein coefficient, induced emission and absorption, ultra wave, IR and Raman spectroscopy of diatomic molecules- Determination of molecular parameters, vibrational spectra of polyatomic molecules- definition of normal modes and normal coordinates. IR and Raman active fundamentals, overtone and combination bands- concept of group frequencies, coupling interaction bands Fermi resonance, Basic concept of FT-IR. Electronic Spectra of diatomic and polyatomic molecules, Born-oppenheimer approximations, Franck-condon principle, dissoci energy, Rotational fine structure and Fortrat diagram.

Unit V

Spectroscopy II

H^1-NMR, introduction,theory of splitting of Nuclear zeeman levels in a magnetic field, chemical shift, spin- spin splitting, dipolar interactions, relaxation times, line shape and line width, experimental techniques- double resonance technique, ENDOR , overhauser, effect, FT-umr spectroscopy – Lanthanide shift reagents.

ESR spectroscopy – hyperfine splitting, factors affecting the maginitude of the ‘g’ values, solid state epr, rate of electron exchange reactions, fine structure and hyperfine structures, electron density from esr, theory of esr spectra of free radicalso.

Photoelectron spectroscopy - basic principles, instrumentation X-ray photoelectron and uv photoelectron spectra, core energy level studies- application of ESCA; laser , Raman spectroscopy theory of Raman Scattering, techniques and instrumentation, the lase source, applications of laser Raman Spectroscopy, structure determination.

References

1. K.J. Laidler, Chemical Kinetics, 2^{nd} edn., Tata Mc Graw Hill, New Delhi, 15^{th} reprint 1991.
2. K.J. Laidler, Theories of Chemical Reaction rates, Mc Graw Hill, New York, 1969.
3. K.K. Rohatgi –Mukerjee, Fundamentals of photochemistry.
4. J.N. Bradley, Fast Reaction.
5. N.J. Turo, Modern Molecular Photochemistry
6. F.A. Cotton, Chemical Application of Group theory

7. C.N. Banewell, Spectroscopy
8. Stanghan and Walker, Spectroscopy, Vol. 1,2, & 3.

PAPER VIII - BIO- ORGANIC, BIO-INORGANIC AND BIO – PHYSICAL CHEMISTRY

Bio – Organic Chemistry

Unit : I

Nucleic Acids

Purine and pyrimidine bases of nueleic acids. Nucleosides, Nucleosides, Base pairing via H-bonding. Primary and secondary structures of DNA and RNA. Forces responsible for holding double helix structure. Transcription and translation. DNA sequencing, Enzymatic method, PCR technique in chain amplification.

Unit : II

Carbohydrates and Lipids

A. Carbohydrates:

Storage polysaccharides – starch, chitin and glycogen. Structure and biological functions of glucosaminoglycans or mucopolysaccharide. Carbohydrates of glyeoproteins and glycolipids. Role of sugar in biological recognition. Blood group substances.

Carbohydrate metabolism:

Kreb's cycle, glycogenesis and glycogenolysis, gluconeogenesis, Pentose phosphate path way.

B. Lipids:

Fatty acids, essential fatty acid, structure and function of tricylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostoglandins. Lipoproteins- composition and function, role in atherosclerosis. Biological membranes. Fluid mosaic model of memberane structure.

Unit – III

Bioinorganic chemistry I

Non – metals and metals in biological system; essential and trace elements. Classfication of metallobiomolecules – non-proteins, proteins and enzymes. Metallobiosite, its coordination environment and entatic state.

Dioxygen binding and transport – heme proteins: myoglobin and hemoglobin, their structure, function and physiology; non-heme proteins; hemerythrine and hemocyanin.

Biochemical iron storage and transport by Transferrins and siderrophores; metal ion exchange activity of siderophores.

Unit IV

Bioinorganic Chemistry II

Electron transfer in biological systems – Prophyrins and cytochromes; Fe – S cluster proteins (Ferredoxins and rubredoxins) and their synthetic models; blue copper proteins.

Photosynthetic pathway – chlorophyll, PSU, PSII and involvement of Mn complex and Cytochrome C oxidase.

Vitamin B_{12} and coenzymes; in vitro and in vivo nitrogen fixation.

Unit V:

Biophysical chemistry

Thermodynamics in biology – energy flux – transfer of potentials and coupled reactions role of singlet oxygen in biology – general principles of function and structural organization in bioenergetic fundamental reactions- structure of membranes (introductory aspects only) – solute transport across membranes – membrane potentials – ion pumps – biophysical applications of Moussbauer effect.

References

Unit I & II

1. G.L. Zubay, W.W. Parson and D.e. Vance, Principles of Biochemistry, Wm. C. Brown Publishers 1995.
2. G.L. zubay, Biochemistry, WMC Brown publishers, Chicago, 1998.
3. L. Stryer, Biochemistry (4^{th} edn.) W.H. Freeman and Company, 1995.

Unit III & IV

1. D.E. Fenton, Biocoordination Chemistry, Oxford Chemistry, Primer Series, Oxford Science Publications, Oxford, 1995.
2. W.L. Jolly, Modern Inorganic chemistry, Mc Graw Hill Company 2^{nd} edn. 1991.
3. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry, Harper and Row, 4^{th} edn. 1993.
4. B. Douglas and D. McDaniel and J. Alexander Concepts and Models of Inorganic Chemistry, John Wiley & Sons, 2^{nd} edn. 1983.

Unit V

1. A.G. Marshall, Biophysical Chemistry, John Wiley and Sons, New York, 1978.
2. K.J. Laidler, Physical Chemistry with Biological Applications, Benjamin, 1980.
3. A.L. Lehninger, D.I. Nelson and M.M. Cox, Principles of Biochemistry, Worth Publishers Inc. USA. 1993.
4. G.L. Zubay Biochemistry, Wm.C. Brown Publishers, Chicago, 1998.

Practicals

First year

Practical Paper – I – Organic Chemistry Practicals

(Examination at the end of I year)

1. Separation and characterization of two component mixtures.
2. Two stage preparations involving nitration, bromination, diazotization, rearrangement and aocetylation.

   The University examination will consist of:

   a) Separation of binary mixture (Separation to be given in Semi – micro quantity only.
      Report and complete separation of the components required ---- 15% marks.
   b) A bifunctional organic substance will be given separately for analysis
      Both the groups must be reported. Complete procedure and solid derivative are to be reported.
   c) Preparation involving 2 stages – Recrystallised final product and the crude products are to be exhibited.
   d) Viva – Voce
   e) Record.

Practicals II year (Examination at the end of II Year)

Skill developments in the following laboratory, experiments are required.

1. Qualitative (systematic) analysis of inorganic mixture containing two less familiar cations.
2. Direct to indirect (Back titration methods of estimation of ca, zn, cu, by EDTA titration.
3. Separation and estimation of minutes buy volumetric and gratimetric methods.
   i) Cu2 + & Ni2
   ii)Fe2 + & Cu2+
   iii)Cu2 + & Zn2+
4. Preparation of Inorganic metal complexes (atleast 10 different complexes)

The university Examination will consist of

a. Qualitative analysis of 2 less	: 25% Marks
b. EDTA titration or separation and estimation of one metal ion in a mirture of two.	:25% Marks
c. Preparation of complexes	:10% Marks
d. Viva Voce	:20% Marks
e. Record.	:20% Marks

Second year Practical Paper III

Physical Chemistry Practicals (Examination at the end of II year)

Conductometric Titrations:

1. NH_4cl – NaoH - (NH_4cl + HCL)
2. NH_4cl – NaoH -(Hcl + CH_3 COOH)
3. CH_3cooNa – Hcl – BufferCCH_3 COONA + CH3COOH

(NaOH strength given)

4.Preciptation titration

Kcl – AgNo3 – (Kcl_ki Mixture)

5. Determinaion of dissociation constant of Weak acid
6. Heat of solution bybsolubility method.

Potentimetry

7. Redox titrations

KI – Kmno4 – KI

8. Fe^{2+} - $k_2Cr_2O_7$ – Fe^{2+}
9. Fe^{2+}-ceric – Fe^{2+}
10. Cl – Ag – cl +I
11. Dissociation constant of weak acid
12. solubility product by chemical cell and concentration cell.
13. Adsorption of oxalic acid/acetic acid on charcoal.

Scheme of Valuation

Experiment - 60%

Record - 20%

Viva -20%
