S.K.C.G. (AUTONOMOUS) COLLEGE

PARALAKHEMUNDI - 761200

COURSES OF STUDIES

FOR

THE M.Sc. EXAMINATION

CHEMISTRY

Published By

S.K.C.G. (AUTONOMOUS) COLLEGE

PARALAKHEMUNDI - 761200

COURSES OF STUDIES
FOR
MASTER OF SCEINCE IN CHEMISTRY

2017

Full Marks:

SEMESTER- I

Paper-411 :	Organic Chemistry Theory-I (Gen)	50 (40+10)
Paper-412 :	Organic Chemistry Theory-II (Gen)	50 (40+10)
Paper-413 :	Organic Chemistry Theory-III (Gen)	50 (40+10)
Paper-414 :	Organic Chemistry (Practical)	50
Paper-415 :	Organic Chemistry (Practical)	50

SEMESTER- II

Paper-421 :	Inorganic Chemistry Theory-I (Gen)	50 (40+10)
Paper-422 :	Inorganic Chemistry Theory-II (Gen)	50 (40+10)
Paper-423 :	Inorganic Chemistry Theory-III (Gen)	50 (40+10)
Paper-424 :	Inorganic Chemistry (Practical)	50
Paper-425 :	Inorganic Chemistry (Practical)	50

SEMESTER- III

Paper-431 :	Physical Chemistry Theory-I (Gen)	50 (40+10)
Paper-432 :	Physical Chemistry Theory-II (Gen)	50 (40+10)
Paper-433 :	Physical Chemistry Theory-III (Gen)	50 (40+10)
Paper-434 :	Physical Chemistry (Practical)	50
Paper-435 :	Physical Chemistry (Practical)	50

SEMESTER- IV

Paper-441 :	Organic Chemistry Theory-I (Special)	50 (40+10)
Paper-442 :	Organic Chemistry Theory-II (Special)	50 (40+10)
Paper-443 :	Organic Chemistry Theory-III (Special)	50 (40+10)
Paper-444 :	Organic Chemistry (Practical) (Special)	50
Paper-445 :	Organic Chemistry (Practical) (Special)	50

P.G. CHEMISTRY
SEMESTER- I
PAPER – 411
ORGANIC CHEMISTRY THEORY – I (GENERAL)

Full Marks: 50 (40 + 10)

UNIT – I : REACTION MECHANISM

Structure and Reactivity: Types of mechanisms, thermodynamic control, Hammond's Postulates, curtin-Hammett Principle, potential energy diagrams, Transition states and intermediates, isotope effects, Hard and Soft acids and bases, The Hammett equation and linear free energy relationship, substituents and reaction constants, Taft equation.

UNIT – II : ALIPHATIC NUCLEOPHILIC SUSSTITUTION:

SN^2, SN^1 Mechanisms, Neighbouring group participation by σ and π bonds, anchimeric assistance, classical and nonclassical carbocations, Phenonium ions, norbornyl system, the Sni mechanism, Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon, Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile, regioselectivity.

Aliphatic Electrophilic Substitution:

Bimolecular mechanism – SE2, SE1, the Sei mechanism, electrophilic substitution accompanied by double bond shifts, effect of substrates, leaving group and the solvent polarity on reactivity.

UNIT - III : AROMATIC NUCLEPHILIC SUBSTITUTION:

The SNAr, SN1, benzyne and SRN1 mechanisms. Reactivity – effect of substrate structure, leaving group and attacking nucleophile. The Von-Richter, Sommelet – Hauser and Smile's rearrangements.

Aromatic Electrophilic Substitution:

The Aremium ion mechanism, Orientation and reactivity, the ortho and para ratio, ipso attack, quantitative treatment of reactivity in substrates and electrophiles, diazonium coupling, Vilsmeir reaction, Gattermank koch reaction, Bischler – Napieralski reaction, Houben – Hoesch reaction, Fries rearrangement, Pechmann reaction.

UNIT – IV : FREE-RADICAL REACTIONS:

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance, reactivity for aliphatic and aromatic substrates at a bridge head. The effect of solvents on reactivity, allylic halogenation (NBS), Oxidation of aldehydes to Carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, free-radical rearrangements, Sandmeyer's reaction, Hunsdiecker reaction, Kochi reaction, Gomberg – Bachmann reaction.

Elimination Reactions:

The E2, E1 and E1CB mechanisms. Orientation of the double bond. Reactivity – effects of substrate structures, attacking base, the leaving group and the medium.

Internal Assessment 10 Marks

P.G. CHEMISTRY
SEMESTER- I
PAPER – 412
ORGANIC CHEMISTRY THEORY – II (GENERAL)

Full Marks: 50 (40 + 10)

UNIT – I : ADDITION TO CARBON – CARBON MULTIPLE BONDS:

Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio and chemeo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, hydroboration, Michael reaction, sharples asymmetric epoxidation.

Addition to Carbon-Hetero Multiple Bonds:

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles. Addition of Grignard reagents to carbonyl compounds, Wittig reaction, Mechanism of condensation reactions involving enolates – Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions, Hydrolysis of esters and amides.

UNIT-II : APPLICATION OF ORGANO – METALLICS IN ORGANIC SYNTHESIS:

Introduction: Metalion atom functionality in organo metallic reactions, Carbanionic behaviour, carbonium ion behaviour, free radical intermediate, synthetic application of organo zinc, organo cadmium, organo aluminium, organo copper, organo mercury and organo silicon compounds, Rearrangements catalysed by metal ions and complexes.

Mechanism of Molecular Rearrangements:

A detailed study of the following rearrangements: Pinacol-Pinacolone, Wagner – Meerwein, tiffenev – Demjanov, dienone – Phenol, Benzil – Benzilic acid, Favorskii, Wolff, Neber, Curtius, Schmidt, Beckmann, Baeyer-Villiger, Hofmann and Shapiro reaction.

UNIT – III : Pericyclic Reactions:

Molecular Orbital Symmetry, Frontier Orbitals of ethylene, 1,3- butadiene, 1,3,5-hexa teriene and allyl systems, classification of pericyclic reactions – Woodward-Hoffmann Correlation diagram, FMO and PMO approach, Electrocyclic reactions – conrotarory and disrotatory motions, 4n and 4n+2 and allyl systems. Cycloadditons – antarafacial and suprafacial additions, 4n and 4n+2 sytems, 2+2 addition of ketenes, 1, 3 dipolar cycloadditions and cheleotropic reactions.

Sigmatropic rearrangements – Suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3, 3 – and 5, 5- sigmatropic rearrangements, Claisen and Cope rearrangements, Ene reaction.

UNIT – IV: OXIDATION:

Introduction: different oxidative processes, Hydrocarbons, alkenes, aromatic rings, saturated C-H groups, alcohols, diols, aldehydes, ketones and carboxylic acids, amines. Oxidation with ruthenium tetroxide, Iodobenzene diacetate, Thallium (III) nitrate.

Reduction:

Introduction: Different reductive process, hydrocarbon: alkenes, alkynes and aromatic rings, carbonyl compounds – aldehydes, ketones, acids and their derivatives, hydrogenolysis.

Internal Assessment 10 Marks

P.G. CHEMISTRY
SEMESTER- I
PAPER – 413
ORGANIC CHEMISTRY THEORY – III (GENERAL)

Full Marks: 50 (40 + 10)

UNIT – I : STEREOCHEMISTRY:

Conformational analysis of cycloalkanes and decalins, effect of conformation on reactivity, optical activity in the absence of chiral carbon (biphenyl, allenes and spirans), chirality due to helical shape, asymmetric synthesis.

UNIT-II : ORGANIC PHOTOCHEMISTRY:

Light absorption, fluorescence and Phosphorescence, Jablenski diagram, Photodisociation reactions, Norrish type-I cleavage and Norrish type-II cleavage, Photochemical reductions, Photoisomerisation, Di-Pi-Methane rearrangements, Barton reaction, Photo-Fries rearrangement, Photochemistry of aromatic compounds, singlet molecular oxygen reaction.

UNIT – III : APPLICATION OF UV SPECTROSCOPY:

Basic principles, Ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser – woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds, steric effect in biphenyls.

Application of IR spectroscopy:

Theory of molecular vibrations, vibrational frequency, finger print region, characteristic vibrational frequency of alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols and phenols, detailed study of IR spectra of carbonyl compounds (aldehydes, ketones, acids, esters, amides), amines, nitro compounds and nitriles, effect of hydrogen bonding and solvent effect on vibrational frequencies overtones.

UNIT – IV : APPLICATIONS OF NMR SPECTROSCOPY:

Chemical shift, spin – spin interaction, shielding mechanism, chemical shift values and correction for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic), chemical exchange, effect of deuteration, hindered rotation, contact shift reagents, NMR spectra of simple molecules like n-propanol, 1,3-dichloro propane, benzaldehyde, 2, 3 dibromo propene and cis and trans – stilbene.

Applications of Mass Spectroscopy:

Introduction: Ion production, Ion analysis, Mass spectral fragmentation of organic compounds, Molecular ion peak, metastable peak, Mc Lafferty rearrangement, nitrogen rule, examples of Mass spectral fragmentation of simple organic compounds.

Internal Assessment 10 Marks

P.G. CHEMISTRY
SEMESTER- I
PAPER – 414
ORGANIC CHEMISTRY (PRACTICAL)

Full Marks: 50

1. Identification of organic compounds having at least two functional groups.

2. Synthesis of Organic Compounds: Preparation of

(a) P-nitroacetanilide,	(b) P-nitroaniline,
(c) m-dinitrobenzene,	(d) Methyl orange,
(e) Sulphanilic acid,	(f) Ethyl benzoate,
(g) P-iodotoulene,	(h) P-bromoacetanilide,
(i) O-bromoaniline,	(j) m-nitroaniline.

P.G. CHEMISTRY
SEMESTER- I
PAPER – 415
ORGANIC CHEMISTRY (PRACTICAL)

Full Marks: 50

1. Estimation of (a) acetyl group, (b) Phenol group, (c) Keto group, (d) Nitrogen by (KJheldahl's) method, (e) Sulphur.

2. Synthesis of simple dye and check its purity by paper chromatog raphy and extinction coefficient measurements.

SEMESTER -II

PAPER – 421

INORGANIC CHEMISTRY THEORY – I (GENERAL)

Full Marks: 50 (40 + 10)

Unit – I

Matter waves, the uncertainity principle, Schrodinger wave equation, Postulates of quantum mechanics, Particle in one and three dimensional boxes, Wave mechanical picture of hydrogen atom. Harmonic Oscillator, rigid rotor, the shapes of s, p and d atomic orbitals.

Qualitative treatment for many-electron atoms, the self-consistent field theory, the variation principle, angular momentum, LS and JJ coupling, spectral terms: $p^1 - p^6$ and $d^1 - d^{10}$ metal ions.

Unit – II

The covalent bond, qualitative discussion on valence bond theory: the hydrogen molecule – perturbation and variation methods, the secular equation, resonance and contribution of ionic terms, qualitative discussion on molecular orbital theory: the hydrogen molecule – bonding and antibonding orbitals, energy distribution and stability, MO energy level diagrams of simple diatomic molecules like N_2, O_2, F_2, CO and NO.

Unit – III

Directional characteristics of covalent bond, hybridization and hybrid orbitals – SP, SP^2, SP^3 (with wave mechanical model), dsp^2, dsp^3 and d^2sp^3 (qualitative idea). VSEPR theory, shapes of simple molecules like N_2O, F_2O, ICL_2, ICL_3, PF_5, CIF_3, SF_6, IF_5, IF_7, $Tecl_4$, $XeOF_4$, XeF_6.

Unit – IV

Crystal defects and Non-stoichiometry: Perfect and imperfect crystals, intrinsic and extrinsic defects. Point defects, line and plane defects, Schottky defects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centers, non-stoichiometry and defects.

Electronic properties and band theory in solids: Metals, insulators and semiconductors, Electronic structure of solids – band theory, band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions.

Solid state Reactions: General principles, experimental procedures, co-precipitation as a precursor to solid state reactions, Kinetics of solid state reactions.

Internal Assessment 10 Marks

SEMESTER -II

PAPER – 422

INORGANIC CHEMISTRY THEORY – II (GENERAL)

Full Marks: 50 (40 + 10)

UNIT - I

Elementary idea about magnetochemistry of metal complexes, diamagnetism, paramagnetism, and temperature independent paramagnetism, magnetic susceptibility and its measurements. Types of paramagnetism as applied to metal complexes. Elementary idea about ferromagnetism, ferrimagnetism, and antiferromagnetism.

Elementary idea about electronic spectral properties of some simple metal complexes. Electronic spectra and Orgel diagram of simple complexes of ions $(Ti+\hat{3}, Cr+\hat{3}, Co+\hat{2}, Co+\hat{3})$ in octahedral and tetrahedral fields.

UNIT - II

Metal – Ligand Equilibria in solution: Step-wise and overall formation constants and their interaction, trends in Step-wise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH – metry and spectrophotometry.

UNIT - III

Bonding in coordination compounds. Valence bond theory – its strength and short comings. Crystal field theory and crystal field effects. Spin types, CFSE, measurements of IODq. Evidence for crystal field stabilization in octahedral, tetrahedral, tetragonally distorted, square pyramidal and square planner fields. ACFT / LFT, Molecular orbital theory (qualitative). MO energy level diagrams. Sigma and pi-bonding and their importance in coordination complexex.

UNIT - IV

Reaction Mechanism of Transition metal complexes: Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, Kinetics of octahedral substitution, general mechanism (D, Id, ia and A) acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, Direct and indirect evidences in favour of conjugate mechanism. Anation reactions, reactions without metal ligand bond cleavage, substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reactions.

Structure and reactivity in redox reactions of coordination compounds. Electron transfer vs. atom transfer, Complementary and noncomplementary redox reactions. One electron and two electron transfer reactions. Mechanisms of electron transfer - outer sphere mechanism and Marcus theory, Inner sphere mechanism.

Internal Assessment 10 Marks

SEMESTER -II

PAPER – 423

INORGANIC CHEMISTRY THEORY – III (GENERAL)

Full Marks: 50 (40 + 10)

UNIT - I

Artificial Radioactivity: Artificial radioactivity and nuclear reactions, discovery, concepts of potential barrier, Radioactive decay law, Half-life period. Theory of alpha and beta decay. Charactersistics of nuclear reactions. Q-value – Threshold cross-section, bohr's theory of compound nucleus.

Nuclear reactions due to alpha and beta particles, neutrons, protons, deutrons, heavy ions and gamma irradiation Nuclear fusion and fission. Resonance capture, fission products, mass and charge distribution.

UNIT - II

Chemistry of metal carbonyls: constitution of metal carbonyls of mononuclear, polynuclear and clusters with terminal and bridging carbon monoxide ligand units, carbonylate arion, carbonyl hydrides and carbonyl halides. Metal nitrosyls and other types of metal nitric-oxide complexes, cyanonitrosyl complexes of metals, the brown - ring compounds

Elementary structural aspects of Inorganic catenation and hetero catenation, Inorganic ring compounds. Borazines and phosphazines and their derivatives. Inorganic cages - borides and carbides.

UNIT - III

Elementary study of bio-inorganic chemistry, role of metal ions and other inorganic elements in biological systems, Active transport system, Daniel-Davisson model of cell, molecular mechanism of alkali ion (Na+ & K+) transport, antibiotic - valinomycin, Ionophores, transport by anionic carriers, sodium, potassium pump.

Metalloporphyrins: Iron porphyrins, the iron and dioxygen transport system. Hemoglobin and Myoglobin, O2 affinity. Cooperativity and Bohr's effect. Non-heme proteins: Ferredoxins, nitrogenase, structure and function of nitrogenase in relation to bioorganic aspects of nitrogen fixation. Structure and biological role of vitamin B12.

UNIT - IV

Organometallic Compounds: Classification, nomeanclature and characteristics of organometallic compounds - Introduction, classification based on hepaticity, classification based on the polarity of M-C bond, general characteristics of different types of organometallic compounds. Few transition metal organo metallics as catalytic and synthetic agents.

Chemistry of metallocenes, synthesis and reactions of ferrocene - Bonding and structure of metallocenes with special reference to ferrocene - the eighteen electron rule, MO picture (qualitative).

Internal Assessment 10 Marks

SEMESTER -II

PAPER – 424 (PRACTICAL)

INORGANIC CHEMISTRY (GENERAL)

Full Marks: 50

1. Qualitative analysis of mixtures containing not less than six radicals (organic acid radicals should be excluded). Any one of the following rare metal ions may be included (a) Vanadium, (b) Molybdenum, (c) Tungsten, (d) Titanium..

2. Preparation and characterization (including spectroscopic methods) of the following inorganic complexes.

a) Heaammine cobalt (III) Chloride

b) Tris (oxalato) Chromate (III)

PAPER – 425 (PRACTICAL)

INORGANIC CHEMISTRY (GENERAL)

Full Marks: 50

1. Quantitative analysis Use of EDTA as volumetric reagent

a) Standardization of EDTA

b) Determination Ca^{++} and Mg^{++}

c) Determination of tin and Lead in Type metal

d) Determination of Nickel in stainless steel

2. A complete analysis of following:

a) Brass

b) Cement

c) Chrome iron ore

SEMESTER-III

PAPER – 431

PHYSICAL CHEMISTRY THEORY – I (GENERAL)

Full Marks: 50 (40 + 10)

UNIT – I

Brief resume of the concept of enthalpies, entropy, free energy, and laws of thermodynamics, Partial molar properties. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determination of partial molar properties by (i) direct method, (ii) from apparent molar properties, (iii) method of intercepts.Thermodynamics of ideal and real gases and gas mixtures. Fugacity of gases and their determination by

(i) graphical method,
(ii) from equation of state,
(iii) approximate method.

UNIT – II

Nernst heat theorem, application to solids, third Law of thermodynamics, experimental determination of entropy by third law.

Statistical Thermodynamics:

Thermodynamic probability and entropy, Maxwell Boltxmann statistics, partition function (transnational, vibrational, rotational) for diatomic molecules. Calculation of thermodynamic functions and equilibrium constant from molecular properties.

UNIT – III

Activity and activity coefficient of electrolytes, ionic strength, Debye – Huckel limiting law and its verification. Determination of activity coefficient by freezing point, vapour pressure and solubility measurements, Ion – Association, fraction of association, Association constant, Determination of dissociation constant of electrolytes.

Standard electrode potential and its determination. Relationship between EMF and free energy, entropy and heat change. Applications of EMF measurements. Determination of ionic product of water, acid base dissociation constants and pH of solution, and solubility product, Liquid junction potential and its elimination. Storage batteries, fuel cells, Potentioemtric titration.

UNIT – IV

Acids and bases, strength of acids and bases in nonaqueous media, hydrogen ion concentration in ampholytes and isoelectic point.

Electrolytic polarization, decomposition potential, overvoltage (elementary treatment), construction and working of dropping mercury electrode and its analytical applications.

Internal Assessment 10 Marks

SEMESTER-III

PAPER – 432

PHYSICAL CHEMISTRY THEORY – II (GENERAL)

Full Marks: 50 (40 + 10)

UNIT – I

Kinetics of complex (consecutive, concurrent and reversible) reactions. Arrhenius equations, potential energy surfaces, collision theory of bimolecular reactions, test for the validity of the collision theory, interpretation of frequency tests, study of kinetics of

$H_2 + I_2 \rightleftharpoons 2HI$

in terms of collision theory. Steady state treatment, theory of absolute reaction rate. Catalysis - Acid-base catalysis.

UNIT – II

Symmetry and group theory:

Symmetry elements and symmetry operations, definitions of group, subgroup, relation between orders of finite group and its subgroup. Conjugacy relation and classes, point symmetry group, schonflies symbols, representation of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh, etc. groups to be worked out explicitly), character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use.

UNIT – III

Macromolecules:

Concept of molecular mass, number and mass average molecular mass. Determination of molecular mass (Osmometry, Viscometry, diffusion and light scattering methods), Sedimentation, chain configuration of macromolecules, calculation of average dimensions of various chain structures.

UNIT – IV

Surface Chemistry:

Freundlich adsorption, Langmuir adsorption, Gibbs adsorption isotherm, BET equation, application of BET equation for determination of surface area, catalytic activity at surfaces.

Internal Assessment 10 Marks

SEMESTER-III

PAPER – 433

PHYSICAL CHEMISTRY THEORY – III (GENERAL)

Full Marks: 50 (40 + 10)

UNIT – I

Laws of photo chemistry, quantum yield and its measurement, principle of fluorescene, phosphorescenes chemiluminescence and photosensitisation. Flash photolysis.

Molecular Spectroscopy: Rotational Spectra of diatomic molecule – rigid rotator, intensity of spectral lines, effect of isotopic substitution, nonrigid rotator and its spectrum, Calculation of internuclear distances.

UNIT – II

Infrared Spectroscopy: The vibrating diatomic molecule, linear harmonic oscillator, unharmonic vibration, vibration – rotation fine structure. P, Q, R branch, Parallel vibrations and perpendicular vibrations in symmetric top molecules. Elementary idea about FT IR spectroscopy.

Raman Spectroscopy: Classical and quantum theory of Raman effect, pure rotational Raman spectra, Vibrational Raman Spectra. Polarisation of light and Raman effect, Structure determination by Raman and IR spectroscopy.

UNIT – III

ESR Spectroscopy:

Basic principle, hyperfine splitting in some simple systems – Hydrogen atom, Deuterium methyl radical, Factors affecting the 'g' values, zero field splitting and Kramer's degeneracy, applications of e.s.r. spectra.

Mossbauer Spectroscopy: Principle of Mossbauer Spectroscopy, experimental technique, Hyperfine interactions in Mossbauer Spectroscopy. Application in determining nature of bond and structure of compounds.

UNIT – IV

Photoelectron Spectroscopy:

Basic Principle, photoelectric effect, photoelectron spectra of simple molecules like N_2, CO, ESCA, Chemical information from ESCA.

Nuclear Magnetic Resonance Spectroscopy: Theory, precession and resonance, mechanism of measurement, chemical shift, factors affecting chemical shift, Relaxation process, Spin-Spin coupling, coupling constant, germinal coupling, vicinal coupling, long-range coupling double resonance.

Internal Assessment 10 Marks

SEMESTER-III PAPER – 434 (PRACTICAL)
PHYSICAL CHEMISTRY (GENERAL)

Full Marks: 50

1. Kinetic study of hydrolysis of an ester (Acid and alkaline hydrolysis) and Comparison of strength of acids.
2. Determination of the velocity constant of hydrolysis of an ester in micellar media.
3. Study the critical solution temperature and effect of impurities.
   To determine the plait point from the phase diagram of three component partially miscible liquid system.
4. To determine the partition coefficient for distribution of iodine between CCl_4 and water.
5. Study the distribution of benzoic acid between benzene and water.
6. Determine the percentage of glycerol water mixture and radius of the glycerol molecule from viscosity measurements.
7. Determination of molecular weight by Victor mixer method.
8. Determination of heat of solution of sparingly soluble salt from solubility measurement.
9. Determiantion of C M C of sodium dodecyl sulphate by spectro photom etry / conductometry / surface tension measurements.

SEMESTER-III PAPER – 435 (PRACTICAL)
PHYSICAL CHEMISTRY (GENERAL)

Full Marks: 50

1. Surface tension of liquid and liquid mixtures by drop weight method.
2. Study of inversion of sucrose by polarimetry – comparison of strength of acids.
3. Absorption isotherm (Freundlich) verification and preparation of sols.
4. Conductometric titrations – Neutralisation and precipitation reactions.
5. Determination of hydrolysis constant of aniline hydrochloride by conductometry.
6. Determination of thermodynamic dissociation constant of a weak acid by potentiometry and conductometry.
7. Determination of the strength of strong and weak acids in a given mixture using a potentiometer / PH meter.
8. Determination of thermodynamic constants, ΔG, ΔS and ΔH for the reac tion by e.m.f. method. $Zn + H_2SO_4 \rightarrow ZnSO_4 + 2H$
9. Transport number of Cu^{2+} by Hittorf's method.
10. Determination of activation energy for the acid hydrolysis of an ester.

SEMESTER-IV
PAPER – 441
ORGANIC CHEMISTRY THEORY – I (SPECIAL)

Full Marks: 50 (40 + 10)

UNIT – I

Multiple Synthetic Strategy:
Concept of protective groups, principles of protection of hydroxy, amino, carbonyl and carboxyl groups, synthetic equa-equivalent groups, concept of umpolong, synthetic strategy in the retro synthesis of Jubavione and Longifolene.

Total synthesis of the following alkaloids will be studied. Quinine, Strychnine, Resperpine and Lycopodine.

UNIT – II

Synthesis of the following terpenes will be studied: Camphor, Santonin, Abietic acid and Squalene.

Synthesis of the following steroids will be studied. Cholesterol, Bile acids, androsterone and Estrone.

UNIT – III

Chemistry and Physiology of Prostaglandin. Synthesis of di-PGE_1, PGE_2 and $PG_2\alpha$

Studies on Biosynthetic Pathways of Natural Products:
The acetate hypothesis, poly-betaketo acids, their aldol type cyclisation and meta orientation of hydroxy groups in naturally occurring phenols, biogenesis of mascon, isoprene rule, mechanism of formation of meralonic acid from acetycoenzyme – A, Biogenetic isoprene rule, thrujine Pyro-Phosphate and its vonversion into alphapinene, thujine and burneol. Farnesyl and geranyl geranyl pyrophosphates and their conversion into cardinanes and abietic acid.

UNIT – IV

A general study of the following type of drugs:
Histamines and antihistaminic agents, analgestic and antiviral agents, antifertility agents, anti-inflammatory agents, Diuretics and cardiac agents.

Structure determination and synthesis of the following antibiotics:
Penicillin, Streptomycin, Tetracyclin and chloramphenicol.

Internal Assessment 10 Marks

SEMESTER-IV
PAPER – 442
ORGANIC CHEMISTRY THEORY – II (SPECIAL)

Full Marks: 50 (40 + 10)

UNIT – I

Nucleophilic and Electrophilic Reactivity:
Structure and electronic effects on SN1 and SN2 reactivity; Solvent effects. Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of SN2 reaction. Nucleophilicity and SN2 reactivity based on curve-crossing model. Relationship between polar and electron transfer reactions. SRN1 mechanism. Electrophilic reactivity, general mechanism. Kinetic of SE2 – Ar reaction. Structural effects on rates and selectivity. Curve – crossing approach to electrophilic reactivity.

UNIT – II

Synthesis of Exotic Molecules:
Barralene, Basketene, Cubane, Bullvalene, Dewar Benzene, Helicenes and Twistane.

UNIT – III

Organic Photochemistry:
Photo rearrangements of cyclohexadienones, Photochemistry of santonins, Cycloaddition rearrangements of benzene, Molecular oxygen addition reactions, photo fries rearrangement, Photochemistry of Pyridinium yields.

Cycloaddition and unimolecular rearrangements and Eliminations: diels – Alder reactions, Intramolecular Diels – alder reaction, Dipolar cycloaddition reactions, 2+2 cyclo addition reactions leading to cyclobutane, Photochemical cyclo addition reactions, 3+3 sigmatropic shifts, Cope and Claisen rearrangements, 2+3 – sigmatropic rearrangements, Ene reactions, Cheleotropic Eliminations.

UNIT – IV

Reactions of electron Deficient Intermediates:
Carbene – Structure and reactivity, addition reactions, insertion actions, rearrangement reactions, related reactions, Nitrenes – Rearrangement of electro deficient Nitrogen atom, Rearrangement of carbonium ion intermediates. Carbon – Carbon bond formation involving carbonium ions, Fragmentation reactions.

Structure and Reactivity:
Effect of structure on reactivity, Hammett equation (Linear Free Energy Relationship), Taft equation, Substitution constants, Reaction Constants.

Internal Assessment 10 Marks

SEMESTER-IV

PAPER – 443

ORGANIC CHEMISTRY THEORY – III (SPECIAL)

Full Marks: 50 (40 + 10)

UNIT – I

Reactions of carboxylic acids and esters:

Esterification and Hydrolysis of Esters – Multiplicity and classification of the BAC-2, AAC-2, AAr-1, BAr-1 mechanisms and BAr-2 ester hydrolysis mechanism, hydrolysis of acid anhydrides and chlorides, Formation and hydrolysis of amides, Decarboxylation mechanisms.

Reaction of Carbon Nucleophiles with Carbonyl group:

Aldol condensation, amine – Catalysed aldol condensation reactions. The Mannich reaction, Acylation of carbanions. The Claisen, Dieckmann and related carbonyl name reactions, sulphur ylides and related species as nucleophiles.

UNIT – II

Oxidation:

Principls, Oxidation with transition metal Oxidants (Chromium and manganese compounds), oxygen, ozone and peroxides, Pyridinium chlorochromates and pyridinium dichromate, Oxidation of C = C bonds, alcohols, glycol cleavage, allylic oxidation of olefins.

Reduction of Carbonyl and other Functional Groups:

Addition of hydrogen – catalytic hydrogenation, other hydrogen transfer reagents, Group – III hydride transfer reagents, Reduction of carbonyl compounds, Reduction of other functional groups.

Group – IV: hydride donors, Dissolving metal Reductions:

Addition of hydrogen, Reductive elimination of functional group, Reductive Carbon-Carbon bond formation, Reductive deoxygenation of carbonyl groups.

UNIT – III

Catalysis:

Catalysed synthetic processes including heterogenous catalyst, a brief description of phase transfer catalyst, Micellar catalyst, polymer supported reagents and biocatalysis in organic synthesis.

UNIT – IV

Studies on Heterocyclics:

Detailed chemistry of Pyrazoles, Imidazoles, Oxazoles, thiazoles, syndones, Azepines and Indoles.

Internal Assessment 10 Marks

SEMESTER-IV

PAPER – 444 (PRACTICAL)

ORGANIC CHEMISTRY (SPECIAL)

Full Marks: 50

1. Systematic identification of Organic component mixtures:

   (At least 10 mixtures).

2. a) Determination of Molecular Weight By Rast method.

   b) Volumetric titration of:

      i) Benzyl penicillin,

      ii) Ascorbic acid tablets.

   c) Use of EDTA – Estimation of calcium gluconate.

SEMESTER-IV

PAPER – 445 (PRACTICAL)

ORGANIC CHEMISTRY (SPECIAL)

Full Marks: 50

a) Multistep preparation involving at least two steps.

   Determination of lodinge value of oil.

b). Separation of dye mixtures by chromatographic adsorption method.