GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR – 639 005.

(Reaccredited with A Grade status by NAAC)
(Affiliated to Bharathidasan University, Tiruchirappalli.)

DEPARTMENT OF CHEMISTRY
M.Sc. CHEMISTRY

Programme Outcomes

1. Chemistry proficiency in all four disciplines of chemistry, like analytical, Organic, Inorganic and physical.
2. Students acquire the opportunities related to chemistry in government services through public services commission particularly in the field of food safety and health inspector.
3. Students achieve the skills required to succeed in industries , like rubber , petrochemical, food processing , fertilizer and paper industries.
4. Students understand the importance of periodic table including their physical and chemical nature and their role in daily life.
5. Students are able to use modern library searching and methods to obtain information about a topic , chemical, chemical technique or an issue relating to chemistry.

Programme Specific Outcomes

1. After the completion of the programme the students will get global level research opportunities to pursue Ph.D program targeted approach of CSIR- NET examination.
2. To understand and apply principles of organic chemistry for understanding the scientific phenomenon in reaction mechanisms.
3. The importance of various elements present in the periodic table, coordination chemistry and structure of molecules , properties of compounds , structural determination of complexes using theories and instruments were reached.
4. To understand the metal complexes in biological system.
5. To understand the physical aspects of atomic structure , molecular thermodynamics, quantum mechanics , reaction kinetics and group theory.
6. The students are capable of carrying out experiments in organic estimation, derivatives,semi-micro analysics, potentiometry, UV- Visible experiments.

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GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR – 639 005

M. Sc., - CHEMISTRY COURSE STRUCTURE UNDER CBCS SYSTEM

(For the candidates admitted from the year 2016-2017 onwards)

SEMESTER	COURSE	COURSE	SUBJECT CODE	INSTR. HOURS WEEK	CREDIT	EXAM HOURS	MARKS		TOTAL
							INT	ESE	
I	Core Course – I	Inorganic Chemistry - I	P16CH1C1	6	**5**	3	25	75	100
	Core Course – II	Organic Chemistry - I	P16CH1C2	6	**5**	3	25	75	100
	Core Course - III	Inorganic Practical - I	P16CH1C3P	6	**3**	6	40	60	100
	Core Course – IV	Organic Practical - I	P16CH1C4P	6	**3**	6	40	60	100
	Elective Course - I	Pharmaceutical Chemistry	P16CH1E1	6	**5**	3	25	75	100
				30	**21**				**500**
II	Core Course – V	Inorganic Chemistry - II	P16CH2C5	6	**5**	3	25	75	100
	Core Course – VI	Physical Chemistry - I	P16CH2C6	6	**5**	3	25	75	100
	Core Course – VII	Inorganic Practical - II	P16CH2C7P	6	**3**	6	40	60	100
	Core Course – VIII	Organic Practical - II	P16CH2C8P	6	**3**	6	40	60	100
	Elective Course – II	Solid State Chemistry	P16CH2E2	6	**5**	3	25	75	100
				30	**21**				**500**
III	Core Course – IX	Organic Chemistry -II	P16CH3C9	6	**5**	3	25	75	100
	Core Course – X	Physical Methods in Chemistry-I	P16CH3C10	6	**5**	3	25	75	100
	Core Course – XI	Physical Chemistry - II	P16CH3C11	6	**6**	3	25	75	100
	Core Course - XII	Physical Chemistry Practical -I	P16CH3C12P	6	**3**	6	40	60	100
	Elective Course – III	Polymer Chemistry	P16CH3E3	6	**5**	3	25	75	100
				30	**24**				**500**
IV	Core Course – XIII	Physical Chemistry Practical -II	P16CH4C13P	6	**3**	6	40	60	100
	Core Course – XIV	Physical Methods in Chemistry-II	P16CH4C14	6	**5**	3	25	75	100
	Elective Course – IV	Analytical chemistry	P16CH4E4	6	**5**	3	25	75	100
	Elective Course – V	Green chemistry	P16CH4E5	6	**5**	3	25	75	100
	Project Work	Project Work	P16CH4PW	6	**6**	3	**	**	100
				30	**24**				**500**
TOTAL				**120**	**90**				**2000**

** Dissertation – 80 Marks and Viva Voce Examinations – 20 Marks

CHAIRMAN
BOARD OF STUDIES IN CHEMISTRY

CONTROLLER OF EXAMINATIONS

Sl. No.: Subject Code: P16CH1C1

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER I – CORE COURSE - I

(For the candidates admitted from the year 2016-2017 onwards)

INORGANIC CHEMISTRY – I

CSO-1	To gain the knowledge in VB theory and MO theory
CSO-2	Study of hybridization of molecular orbitals and to determine the dipole moment.
CSO-3	To identify the packing efficiency of crystal structure and calculate the radius ratio.
CSO-4	To study the stoichiometric and non-stoichiometric defects and types of semiconductors.
CSO-5	to know the concept of acid base theory and to study the strength of oxyacids.

Unit I - Bonding Models I

Ionic bond - Lattice energy and determination -Born-Lande equation - Application of Born-Haber type calculations - Size effects - Ionic radii - Factors affecting ionic radii - Lewis structure - VB theory.

Molecular orbital theory - Symmetry and overlap - Molecular orbitals of diatomic and triatomic molecules - Walsh diagram of H_2 - Ionization of diatomic molecules.

Unit II - Bonding Models II

Hybridization - Molecular orbital equivalent of hybridization-Delocalization - Resonance - Molecular orbital equivalent of resonance.

Fajan's rule - Results of polarization - Covalent bonding in ionic solid - Charge distribution in molecules - Dipole moment - Determination and applications.

Unit III - Solid State Chemistry I

Cells and description of crystal structure - Close packing of spheres - Packing efficiency - Hexagonal close packed (HCP) and cubic close packed structures (CCP) - Relative density of packing in simple cubic, CCP, HCP and BCC - Tetrahedral and octahedral holes - Limiting radius-ratio rule.

Radius ratio for trigonal, tetrahedral, octahedral and cubic sites - Radius ratio and shape of ionic crystals - Structures of cesium chloride, sodium chloride, zinc blende, fluorite, rutile and calcite .

Unit IV - Solid State Chemistry II

Perovskite structure of spinels - Stoichiometric defects - Schottky and Frenkel defects - Non- stoichiometric defects - Metal excess and metal deficiency defects - Extended defects - Line and plane defects.

Band theory - Semiconductors - Intrinsic and extrinsic type - Fermi level- Flow of current in semiconductors - Band structure - p and n type semiconductors - p-n junction - Superconductivity - Photovoltaic effect.

Solid state reactions - Classification - Thermal decomposition reactions - Reaction between two solids - Improving reactivity of solids.

Unit V - Acid-Base Concept

Solvent system concept - Lewis concept - Classification of Lewis acids - Lewis acid-base reactions - Solvolysis and formation of coordination compounds.

Inductive effects - Strength of oxyacids - Pauling's rule - Acidity of cations in aqueous solution - Hard and Soft Acids and Bases (HSAB) - Pearson's principle - Applications of HSAB theory.

References

1. Inorganic Chemistry, J.E. Huheey, E.A. Keither and R.L. Keiter, Harper Collins College Publisher, New York, 4th edn., 1993.
2. Inorganic Chemistry, D.F. Shriver, P.W. Atkins and CH. Langford, ELBS, Oxford UniversityPress, 2000.
3. Modern Inorganic' Chemistry, W.E. Jolly, McGraw Hill International edn., New York, 1994.
4. Theoretical Principles of Inorganic Chemistry, GS. Manku, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1994.
5. Concepts and Models of Inorganic Chemistry, B.Douglas, D.H.Me Daniel and J.J. Alexander, John Wiley and Sons, New Delhi, 2001.
6. Solid State Chemistry, D.K.Chakrabarthy, New Age International Publishers, New Delhi,2005.

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Sl. No.: | Subject Code: P16CH1C2

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER I – CORE COURSE -II

(For the candidates admitted from the year 2016- 17 onwards)

ORGANIC CHEMISTRY – I

CSO-1	To gain the knowledge in VB theory and MO theory
CSO-2	Study of hybridization of molecular orbitals and to determine the dipole moment.
CSO-3	To identify the packing efficiency of crystal structure and calculate the radius ratio.
CSO-4	To study the stoichiometric and non-stoichiometric defects and types of semiconductors.
CSO-5	to know the concept of acid base theory and to study the strength of oxyacids.

Unit I – Electronic Effects & Aromaticity

Electron Displacement Effects – Inductive and field effect – Delocalised bonds – Rules of resonance- steric inhibition of resonance, steric enhancement of resonance, Hyperconjucation – Hydrogen bonding – Intra and inter molecular hydrogen bonding – effect of hydrogen bonding and hyperconjugation on physical and chemical properties.

Aromaticity: Aromatic systems with 2,6,10 π-electrons, alternent and non-alternent hydrocarbons, systems of more than 10 π-electrons annulenes- aromaticity of azulenes, Sydnones- concept of homoaromaticity.

Unit II – Methods of Determination of Reaction Mechanisms & Reactive Intermediates

Thermodynamic and Kinetic Requirements of Reactions: Thermodynamic and kinetic control – methods of determination of reaction mechanisms – product analysis – determination of the presence of intermediate, isolation, detection, trapping – cross over experiments – isotopic labeling – isotopic effect – stereo chemical evidence – kinetic evidence.

Kinetic Methods of Determination of Reaction Mechanisms: Hammet equation – significance of substitution and reaction constant – Hammond postulates – Linear free energy relationship – limitations and derivations – Taft equation.

Reactive Intermediates: Generation, detection, stability, structure, reactivity and important reactions of carbocations, carbanions, free radicals.

Unit III – UV and IR Spectroscopy

UV Spectroscopy: Introduction – Instrumentation – sample handling techniques – Woodward-Fischer and Scoot rules for conjugated dienes polymers, ketones, aldehydes, α, β - unsaturated acids– Differentiation of geometrical isomers and positional isomers – Disubstituted benzene derivatives – Study of steric effect in aromaticity.

IR Spectroscopy: Molecular vibrations- factors influencing vibrational frequencies- applications of IR spectroscopy to organic compounds – group frequency concept- hydrogen bonding- effect of inductive and mesomeric effects on carbonyl stretching frequency- effect of ring strain on carbonyl stretching frequency.

Unit IV – Organic Photochemistry

Fundamental concepts, Jablonski diagram – energy transfer – characteristics of photo reactions – photo reductions and photo oxidation – photoreactions of carbonyl compounds – Norrish type I and Norrish type II reactions, di-pi methane rearrangement – photochemistry of arenes, photochemistry of alkenes, cis-trans isomerisation – photosensitization and photoaddition – Barton reaction – Paterno Buchi reaction.

Unit V – Chemistry of Carbohydrates and Oxygen Heterocyclics

Chemistry and conformations of disaccharides – sucrose, maltose -trisaccharide – raffinose and polysaccharides – starch and cellulose – chemistry of deoxy sugars and amino sugars (elementary idea only).

Oxygen Heterocyclic Compounds: Classification, color reactions of various classes of flavonoids – chemistry and synthesis of flavones (luteolin).

References

1. Advanced Organic Chemistry, J. March, Wiley Eastern, New Delhi, II edn., 1986.
2. A Guide Book to Mechanism in Organic Chemistry, P. Sykes, Orient Longman, 6th edn.,1988.
3. Applications of Absorption Spectroscopy of Organic Compounds, J.R. Dyer, Prentice-Hall, New Delhi, 1987.
4. Organic Chemistry, I.L. Finar, Vol.2 ELBS, 5th edn., 1974.
5. Molecular Reactions and Photochemistry, C.H. DePuy and O.L. Chapman, Prentice-Hall, New Delhi, 1987.

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Sl. No.: | | Subject Code: | P16CH1C3P |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER I – CORE COURSE -III

(For the candidates admitted from the year 2016-2017 onwards)

INORGANIC CHEMISTRY PRACTICAL – I

CSO-1	Analysis of a mixture containing two common and two rare cations by semi-micro qualitative analysis
CSO-2	Estimates Cu, Fe, Ni, Cr and Mn using photoelectric colorimeter

I. Semi-micro Qualitative Analysis

Semi-micro qualitative analysis of a mixture containing two common and two rare cations.

II. Photocolorimetric Estimation

Estimation of Copper, Iron, Nickel, Chromium and Manganese using photoelectric colorimeter.

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Sl. No.: | | Subject Code: | P16CH1C4P |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER I – CORE COURSE -IV

(For the candidates admitted from the year 2016-2017 onwards)

ORGANIC CHEMISTRY PRACTICAL - I

CSO-1	Analysis of an organic mixture containing two components
CSO-2	Understands the method of the single stage organic preparation

Qualitative Analysis of an organic mixture containing two components.

Pilot separation, bulk separation, analysis, derivatization.

Preparation of Organic compounds.(Single stage).

(a) methyl –m- nitrobenzoate from methylbenzoate (nitration)

(b) glucose pentaacetate from glucose (acetylation)

(c) resorcetophenone from resorcinol (acetylation)

(d) benzophenone oxime from benzophenone (addition)

(e) o-chlorobenzoic acid from anthranillic acid (Sandmayer reaction)

(f) ρ-benzoquinone from hydroquinone (oxidation)

(g) Phenyl-azo-2-napthol from aniline (diazotization)

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Sl. No.: | Subject Code: P16CH1E1

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER I – ELECTIVE COURSE – I

(For the candidates admitted from the year 2016-2017 onwards)

PHARMACEUTICAL CHEMISTRY

CSO-1	To study the physiochemical properties in sulpha drugs.
CSO-2	Learns the importance of antibiotics
CSO-3	To study the applications of analgesics and antipyretics
CSO-4	Gains the knowledge of cardiovascular and anti-tubercular drugs
CSO-5	Relates the antihistamines and anti-malarias.

Unit I - Drug action and sulpha drugs

Physiochemical properties in relation to biological action - influence of route of administration. Biotransformation-absorption from stomach -absorption from intestines -sites of loss - metabolism and excretion, harmful drugs and their side effects.

Sulpha drugs -sulphathiazole, sulphamerazine, sulphaguanidine and other sulpha drugs, - synthesis, mechanism of action -uses.

Unit II - Antibiotics

Antibiotics -A study of Chloramphenicol, Penicillin - semisynthetic Penicillin -gross structural features Streptomycin-Cephalasporin and Tetracycline.

Poly~ne antifungal antibiotics-nystatin, fusicidic acid-griesofulvin. (gross structural features not needed).

Unit III - Analgesics and antipyretics

Study of morphine-structure activity relationship (SAR)-morphine analogues -Codeine - synthetic analgesics- pethidines and methadones -narcotic antagonist. Antipyretic analgesics - salicylic acid, pyrazole and para amino phenol derivatives. sedatives:- -Barbiturates, Benzodiazepines.

Unit IV - Cardio Vascular and anti-tubercular drugs

Cardio Vascular Drugs -classification, cardiac glycosides, antihypertensive and hypotensive agents -mode of action –ntiarythamic agents.

Anti-tubercular drugs -sulphonamides -sulphones, p-amino salicylic acid -INH - ethambutal, Rifampicin.

Unit V - Antihistamines and antimalarials

Antihistamines-introduction -mode of action of anthistamines - SAR -ethylene diamine, ethyl amine, propyl amine and –cyclizine derivatives -synthesis.

Antimalarials-classification -quinine, 4-amino and 8-amino quinolines and pyrimidines.

References

1. Medicinal Chemistry -A Burger-Wiley inter Science -N.Y.Vol.I and II,1990
2. TB of organic, Medicinal and Pharmaceutical Chemistry, O. Wilson, O. Giswold and F. George J.G., Lippincott Company, Philadelphia, 9th edn., 1991.
3. Bentley and Drivers' TB of Pharmaceutical Chemistry.

CHAIRMAN – BOS COE

Sl. No.: | P16CH2C5 |

Subject Code:

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER II – CORE COURSE – V

(For the candidates admitted from the year 2016-2017 onwards)

INORGANIC CHEMISTRY – II

CSO-1	To study the theory and limitations of Coordination compounds
CSO-2	Learns the structure and properties of Coordination compounds
CSO-3	Analysis the reaction mechanism and redox reactions
CSO-4	Understands the electronic spectra of the Coordination complexes
CSO-5	Gains the basic concepts Organometallic chemistry

UNIT I Coordination Chemistry (Bonding)

Crystal field theory (CFT) – Crystal field splitting in octahedral, tetrahedral and square planar complexes - Crystal field stabilization energy and its applications - Weak and strong fields - Pairing energy - Factors affecting the magnitude of crystal field splitting.

Jahn-Teller theorem – Limitations of CFT - Molecular orbital (MO) theory for octahedral, tetrahedral and square planar complexes – Types of pi-bonds-pi-bonding and MO theory – Evidences for pi-bonding.

UNIT II Coordination Chemistry (Structure)

Geometrical and optical isomerism in octahedral and square planar complexes – Stereochemistry of complexes - Symbiosis - Chelate effect – Macrocycles - Magnetic properties – Dia, para, ferro and antiferro magnetisms - Curie's law – Spin isomerism.

Stability constants of complexes and their determination – Stability of unusual oxidation states.

UNIT III Coordination Chemistry (Reaction Mechanism)

Substitution reactions: General mechanism - Schemes of octahedral, tetrahedral and square planar complexes – Dissociative (D) – Associative (A) - Interchange (I) and dissociation types - Linear free energy relationships Racemisation and isomerisation:

Trans-effect - Theories of trans-effect, pi-bonding theory and polarization theory- Application of trans effect-cis effect.

Redox reactions: Inner sphere mechanism - The role of bridging ligand - Outer sphere mechanism - The limiting rate law - Theoretical treatment of electron transfer - Simple applications to bio-inorganic chemistry.

UNIT IV Coordination Chemistry (Electronic spectra of complexes)

Quantum numbers of multi-electron atoms - Russell-Sanders coupling - L-S coupling and micro states – Ground state terms for d^1 – d^{10} ions-Derivation of terms for p^2, p^3, d^1 and d^2 configurations.

Splitting of free ion terms in octahedral field - correlation diagram - Orgel diagrams for d^1 to d^9 ions and Tanabe-Sugano diagrams for d^2 and d^3 ions.

UNIT V Basic Concepts of Organometallic Chemistry

Valence electron count (16/18 electron rules); structure and bonding in mono and polynuclear metal carbonyls; substituted metal carbonyls and related compounds; synthesis and reactivity of metal carbonyls; vibrational spectra of metal carbonyls; dinitrogen and dioxygen as ligands in Organometallic compounds.

Types of M-C bonds; synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes; metallocenes and bent metallocenes; isolobal analogy.

Reactions or Organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and deinsertion; catalysis – Hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

References

1. Inorganic Chemistry, IV edn, J.E. Huheey, E.A. Keither and R.L. Keiter, Harper Collins College Publisher, New York, 1993.
2. Inorganic Chemistry, G.L.Miessler and D.A.Tarr, Pearson, Prentice Publishers, Delhi, 2009.
3. Inorganic Chemistry, D.F. Shriver, P.W. Atkins and CH. Langford, ELBS, Oxford University Press, 2000.
4. Concepts and Models of Inorganic Chemistry, B. Douglas, D.H.Mc Daniel and J.J. Alexander, John Wiley and Sons, New Delhi, 2001.
5. Basic Organometallic Chemistry: Concepts, syntheses and applications of Transistion metal, 2010, CRC Press and Universities Press.

CHAIRMAN – BOS COE

Sl. No.: | | Subject Code: | P16CH2C6 |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER II – CORE COURSE – VI

(For the candidates admitted from the year 2016-2017 onwards)

PHYSICAL CHEMISTRY – I

CSO-1	An understanding of ARRT and Marcus theory
CSO-2	To learn the theory of partition function
CSO-3	Industrial applications of phase equlibria
CSO-4	Developed skills in electrochemical series and electrochemical model
CSO-5	Theory behind batteries

UNIT I- Chemical Kinetics

Theories of reaction rate- Absolute reaction rate theory (ARRT) – Significance of reaction co-ordinate- Potential energy surfaces – Kinetic isotope effect – Molecular dynamics- Marcus theory of electron transfer processes.

Principle of microscopic reversibility – steady-state approximation – Chain reactions: thermal and photochemical reactions between hydrogen and halogens – Explosions and hydrogen – oxygen reactions.

Unit II- Molecular Thermodynamics

Calculation of thermodynamic probability of a system – Difference between thermodynamic proability and statistical probability – Ergodic hypothesis – derivation of Boltzman distribution equation – Physical significance of partition function – Translational, rotational, vibrational and electronic partition functions – Quantum statistics – Bose-Einstein and Fermi- Dirac distribution equations – Comparison of B.E and F.D statistics with Boltzman statistics – Concept of Negative Kelvin Temperature.

Relationships between partition function and thermodynamic properties such as E, H, Cp, Cv, P. Derivation PV=RT, molecular interpretation of entropy – Derivation of S=klnW – Establishment of analogues nature of S= klnW to ds=dqrev/T. Calculation of S, A, G etc., from partition functions – Calculation of equilibrium constants for very simple reactions.

Unit III

Phase Equilibrium

Gibbs-phase rule – Derivation – Application to three component system – Graphical representation – System of three liquids – Systems consisting of two salts and water

Photochemistry and Radiation Chemistry:

Photophysical processes electronically excited molecules Jablonski diagram –Stern – Volmer equation and its applications – experimental techniques in photochemistry – chemical actinometers – lasers and their applications.

Radiation Chemistry

Differences between radiation chemistry and photochemistry – Sources of high energy radiation and interaction with matter – radiolysis of water, solvated electrons – Definition of G value – Curie-Linear energy transfer LET and Rad – Scavenging techniques – Use of dosimetry and dosimeters in radition chemistry – application of radiation chemistry.

Unit IV-Electrochemistry I

Formation of electrical double layer-electrocapillary curves-Lippmann equation-structure of electrified interfaces-Helmholtz-Perrin model-Gouy-Chapman model-electrode kinetics- derivation of the fundamental equation of electrode kinetics. Butler-Volmer equation-low field and high field approximations-Tafel equation.

Unit V- Electrochemistry II

Ionic strength-Debye Huckel theory-Debye-Huckel limiting law-relaxation effect- electrophoretic effect-Debye-Huckel-Onsager (DHO) conductance equation-validity of DHO equation-deviations from the DHO equation.

Lead-acid batteries-Cadimum-Nickel oxide batteries-charging and discharging reactions- Fuel cells- classification.

References

1. Physical Chemistry, P. Atkins and J.D. Paula, 8th edn, Oxford University Press, 2006.
2. Physical Chemistry, Gordon M. Barrow, 6th edn, McGraw-Hill, International, 1996
3. Thermodynamics for Chemists, S. Glasstone, East-West Press, 1994.
4. Non-equilibrium Thermodynamics-Principles and Applications, C. Kalidas and M.V. Sanganaranya, McMillan, India, 2002.
5. Electrochemistry, S. Glasstone, Affiliated East West Press, 1997.
6. Modern Electrochemistry, J.O.M. Bockris and A.K.N. Reddy, Chapter 7, Plenum Press, New York, 1970.
7. Hand book of batteries and fuel cells, D. Linden, McGraw Hill, 1984.

CHAIRMAN – BOS COE

Sl. No.: | | Subject Code: | P16CH2C7P |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER II – CORE COURSE – VII

(For the candidates admitted from the year 2016-2017 onwards)

INORGANIC CHEMISTRY PRACTICAL-II

CSO-1	Estimates the mixture of solutions using Titrimetry and Gravimetry
CSO-2	Understands the method of Complex preparation for Inorganic compounds

Titrimetry and Gravimetry A

mixture of solution(s) should be given for estimation Cu (V)

and Ni (G) Cu (V)

and Zn (G) Fe (V) and Zn (G) Fe (V) and Ni (G) Zn (C) and Cu (G)

Preparation of the following compounds

a. Tetraamminecopper (II) sulphate. b.

Potassiumtrioxalatochromate (III).

c. Potassiumtrioxalatoaluminate (III). d.

Tristhioureacopper (I) chloride.

e. Tristhioureacopper (I) sulphate. f.

Dibenzyltin dichloride.

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Sl. No.: | | Subject Code: | P16CH2C8P |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER II – CORE COURSE – VIII

(For the candidates admitted from the year 2016-2017 onwards)

ORGANIC CHEMISTRY PRACTICAL- II

CSO-1	Learns the principle of Organic Estimations.
CSO-2	Understands the method of double stage organic preparation.

Quantitative analysis of organic compounds

Estimation of phenol, aniline, ketone, glucose, nitrobenzene, saponification value of an oil and Iodine value of an oil.

Preparation of organic compounds (Double stage)

a. p-bromo acetanilide from aniline (acetylation and bromination).

b. acetyl salicylic acid from methyl salicylate (hydrolysis and acetylation).

c. 1,3,5-tribromobenzene from aniline (bromination, diazotization and hydrolysation).

d. p- nitroaniline from acetanilide (nitration and hydrolysis).

e. benzillic acid from benzoin (rearrangement).

f. p-amino benzoic acid from p-nitro toluene (oxidation and reduction).

g. benzanilide from benzophenone (rearrangement).

h. p-bromoaniline from acetanilide (bromination and hydrolysis).

i. m-nitroaniline from nitrobenzene (nitration and reduction).

j. 1,2,4-triacetoxy benzene from hydroquinone (oxidation and acylation).

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Sl. No.: | | Subject Code: | P16CH2E2 |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER II – ELECTIVE COURSE – II

(For the candidates admitted from the year 2016-2017 onwards)

SOLID STATE CHEMISTRY

CSO-1	Understanding the concept of supramolecular chemistry and crystal engineering
CSO-2	Learns about MOF
CSO-3	To study about the preparative methods in solid state chemistry
CSO-4	Developed skills in structures and properties of magnetic materials
CSO-5	Apply the knowledge in solid state organic reactions

UNIT I

Concepts and Languages of supramolecular chemistry. Various types of non - covalent interactions . Hydrogen bonds, C-H…X interactions, Halogen bonds. π – π interactions,non – bonded interactions. Molecular recognition.

Crystal engineering of Organic solids: Hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs. Concepts of different types of synthons based on non-covalent interactions. Principles of crystal engineering and non-covalent synthesis. Polymorphism and Pseudopolymorphism. Supramolecular isomorphism / polymorphism. Crystal engineering of pharmaceutical phases.

UNIT II

M.O.F (Metallo Organic Frame works), Organometallic systems. Combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. Design of nanoporous solids. Inter ligand hydrogen-bonds in metal complexes – implications for drug design. Crystal engineering of NLO materials, OLED.

UNIT III

Preparative methods in solid state chemistry:

General principles of solid state chemistry - Experimental procedure - Crystallizations of solutions, melts, glasses and gels,Solutions and gels : zeolite synthesis, Melts, Glasses - Vapour phase transport methods - Physical methods - Growth of single crystals, Bridgman and stockbarger methods, Zone melting, Precipitation from solution or melt : flux method, Verneuil flame fusion method, Vapour phase transport , Hydrothermal methods, Comparison of different methods - High pressure and hydrothermal methods, Hydrothermal methods, Dry high pressure methods.

UNIT IV

Magnetic Materials

Selected examples of magnetic materials, their structures andproperties - Metals and alloys, Transition metal oxides, Spinels, Garnets, Ilmenites and perovskites, Magnetoplumbites - Applications: structure/property relations: Transformer, Information strorage, Magnetic bubble memory devices, Permanent magnets.

Optical Properties: Luminescence, Lasers : Luminescence and phosphors -Definitions and general comments, Configurational coordinate model, Some phosphor materials, Anti-Stokes phosphors – Lasers- The ruby laser,Neodymium lasers.

UNITV

Organic solid state chemistry:

Topochemical control of solid state organic reactions: Intramolecular reactions : conformational effects, Intermolecular reactions : moleculare packing effects,Photodimerization of o-ethoxy-trans-cinnamic acid (α form, β form, γ form)- role of crystal defects, Control of molecular packing arrangements, Organic reactions within inorganic host structures - Electrically conduction organic solids : organic metals, Conjugated systems, Doped polyacetylene, Polyparaphinylene ,Polypyrrole. - Organic charge transfer complexes.

References:

1. Lehn, J.M. Supramolecular Chemistry, VCH, Wienheim, 1995.
2. Desiraju, G.R. Crystal Engineering: The Design of Organic Solids,Elsevier, Amsterdam, 1989.
3. Desiraju, G.R. & Steiner, T. The weak Hydrogen Bond in Structural Chemistry and Biology: Oxford University press: Oxford, 1999.
4. Jeffrey, G. A. Introduction to Hydrogen Bonding ; Oxford University press: New York, 1997.
5. Lehn, J.M. Transition metals in supramolecular chemistry : John Wiley & sons: New York,1999.
6. Desiraju, G.R. (2001). Current Science, 81, 1038.
7. Rao, C.N.R. (2001). Current Science, 81, 1030.
8. Solid state chemistry and its applications by Anthony R.West, John Wiley & sons

(For Unit III – V, Page no. (562-593,666-679))

9. "Molecule Matters" Saravanakumar, k & Sankararaman, S.,(2007).Resonance,Vol.12, No 11, Page 77. 10. Journals

(i) Crystal Growth and Design. http://www.pubs.acs.org/journals/cgdefu/index.html

(ii)Crystal Engineering Communication, http://www.rsc.org/Publishing/Journals/ce/index.asp

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Sl. No.: Subject Code: P16CH3C9

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER III – CORE COURSE – IX

(For the candidates admitted from the year 2016-2017 onwards)

ORGANIC CHEMISTRY – II

CSO-1	Understanding of organic reaction mechanism
CSO-2	To learn about oxidation and reduction reactions
CSO-3	Developed skills in stereochemistry
CSO-4	Gains the knowledge in FMO theory and cyclo addition reaction
CSO-5	To design the organic reactions using retro synthesis

Unit I – Reaction Mechanism

Reaction Mechanism: Nucleophilic substitution at saturated carbon atom – S_N1 and S_N2 reactions – mechanism and evidences – effect of structure –neighbouring group participation – Non classical carbocations. SN Ar mechanism.

Elimination Reactions: E_1, E_2 and E_1CB – evidences – effect of structure, solvent and base – Hoffmann and Saytzeff rules – stereochemistry of E_1 reaction – Pyrolytic elimination – cis elimination – elimination vs substitution.

Unit II – Oxidation and Reduction reactions

Reduction:Catalytic hydrogenation – Wilkinson Catalyst, dehydrogenation, reduction with LAH, NaBH4, teritarybutoxy aluminium hydride, NaCNBH3, tributyltin hydride, alkali metals for reduction.

Oxidation: Osmium tetroxide, Sharpless asymmetric epoxidation, Ozone, DDQ, Lead tetraacetate, Selenium dioxide, DMSO with either Ac2O or Oxalyl chloride, Dess-Martin reagent.

Unit III –Stereochemistry

R/S system on nomenclature of central and axially chiral molecules – atropisomerism, isomerism of biphenyls, allenes, spiranes compounds – Geometrical isomerism – E/Z nomenclature – determination of configuration of geometrical isomers – Conformational analysis of n-butane, cyclobutane and decalins.

Asymmetric synthesis – substrate controlled methods and auxillary controlled methods – chiral catalyst – Cram's rule – Prelog's rule.

Topical relationship in organic molecules – Homotopic, enantiotopic, diastereotopic groups and faces, Pro R and S descriptors and Re and Si for ligand – Stereospecific and stereoselective reactions(elementary examples)

Unit IV- Pericyclic Reactions

Pericyclic reactions: Concerted reactions – orbital symmetry and correlation diagram approach – FMO and PMO approach, Woodward-Hofmann rules – Electrocyclic reactions (1,3- butadiene-cyclobutene and 1,3,5- hexatriene-cyclohexadiene systems) – cycloadditions [2+2] and [2+4] systems (ethylene-cyclobutane, ethylene and 1,3-butadiene-cyclohexene systems) – selection rules – cycloreversion (reterocycloaddition reactions) – heterocyclic additions – 1,3-dipolar cycloaddition - sigmatropic rearrangements – Sommelet-Hauser, Cope, Fries and Clasien rearrangements.

Unit V – Recent Trends in Organic Synthesis

Retrosynthesis basic concepts (FGI and synthons)

Terpenoids: Biogenesis- Structural elucidation of carophyllene and squalene.

Steroids: Structural elucidation of Cholesterol

References

1. Advanced Organic Chemistry, J. March, Wiley Eastern, New Delhi, 3rd edn., 1986.
2. Stereochemistry of Organic Compounds: Principles and Applications, D. Nasipuri, Wiley Eastern, New Delhi, I edn., 1992.
3. Organic Reaction Mechanisms, Raj K. Bansal, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2nd edn., 1995.
4. Molecular Reactions and Photochemistry, Depuy and Champman, Prentice-Hall, New Delhi, 1987.
5. Organic Chemistry, I.L. Finar, Vol.2 ELBS, 5th edn., 1974.
6. Basic Principles of Organic Stereochemistry, P. Ramesh, I st edn., Meenu Publications, Madurai, 2005.
7. Stereochemistry of Carbon Compounds, E.L. Eliel, McGraw Hill Book Company, New York, 1975.

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Sl. No.: | | Subject Code: | P16CH3C10 |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER III – CORE COURSE – X

(For the candidates admitted from the year 2016-2017 onwards)

PHYSICAL METHODS IN CHEMISTRY - I

CSO-1	To learn the theoretical principles of Microwave, Raman and Electronic spectra
CSO-2	Gains the knowledge in NMR spectroscopy and two dimensional techniques
CSO-3	Analysis of ESR and ORD, CD
CSO-4	Understanding of basic concepts of X-ray diffraction
CSO-5	Relates the applications of SEM, TEM and AFM

UNIT I Theoretical principles of Molecular Spectroscopy: Interaction of electromagnetic radiation with molecular systems – Time evolution of the systems under radiation – Einstein transition probability for induced absorption and spontaneous and stimulated emission. Microwave spectroscopy – rotational spectra of diatomic molecules, rigid and nonrigid rotors, - Intensity of spectral lines, - Effects of isotopic substitution – Microwave spectra of polyatomic molecules – Linear and symmetric top molecules, Infrared spectra – diatomic molecules simple harmonic and anharmonic oscillators diatomic vibrating rotator, rotation-vibration spectrum of carbon monoxide- Raman spectra – Rotational Raman spectra of linear and symmetric top molecules – Vibrational Raman Spectra, Rotational fine structure – Electronic spectra of diatomic molecules.

UNIT II Advanced Spectroscopy : NMR ^{1}H NMR Spectroscopy – Spin Multiplicity – Coupling constant – First order and second order proton, Spin – spin splitting – Dependence of J on dihedral angle – Vicinal and germinal coupling constants– Karplus equation – long range coupling constants, Influence of stereochemical factors on chemical shift of protons. Simplification of complex spectra – Double resonance techniques, shifts reagents, Chemical spin decoupling of rapidly exchangable protons (OH, SH, COOCH, NH, NH2), an elementary treatment of NOE phenomenon. ^{13}C-NMR Spectroscopy – Basic theory of FT – NMR, Relaxation – Broad band decoupling. Off resonance decoupling and chemical shifts of common functional groups, DEPT spectra. Identification of small compounds based on NMR data. 2D Techniques: ^{1}H – ^{1}H COSY, ^{1}H – ^{13}C COSY – HMBC and NOESY.

UNIT III: Advanced Spectroscopy: Electron spin resonance spectroscopy: Basic principles – comparison between esr and nmr spectra – hyperfine splitting – factors affecting the magnitude of g – values – calculation of unpaired electron density on an atom in a delocalized system – applications to organic free radicals. Optical rotator dispersion and circular dichroism: Introduction to theory and terminology – cotton effect – ORD curves – axial haloketone rule and its applications – octant rule – its applications – applications of ORD to determine absolute configuration of monocyclic ketones – comparision between ORD and CD – their inter relationships.

UNIT IV X-ray diffraction: X-ray diffraction by single crystal – Space groups – Systematic absences in X-ray data and identification of lattice types, glide planes and screw axes, X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Structure solution by Heavy atom method and direct method. Determination of absolute configuration of molecules. A brief account of Cambridge Structural Database (CSD) and Protein Data Bank (PDB).

UNIT-V ANALYTICAL TOOLS AND TECHNIQUES Fundamental theory, Instrumentation and applications of SEM, TEM, AFM, AAS, PES and STM spectroscopy. Thermal methods-Instrumentation, applications, limitations of DTA, TGA, DSC, Visco meter and BET surface analysis.

References:

1. C.N. Banwell, FundamentalsofmolecularSpectroscopy, 3rd.ed., TMH, New Delhi, 1983
2. B.P. Straughan and S.Walker SpectroscopyVol.3, Chapman Hall London, 1976.
3. G.M. Barrow, IntroductiontoMolecularSpectroscopy, McGraw Hill, New York, 1964.
4. P.K.Ghosh, IntroductiontoPhotoelectronSpectroscopy, John Wiley New York, 1989.
5. P.M. Silverstein, F. X. Wester, SpectroscopicIdentificationofOrganicCompounds, 6th ed., Wiley 1998.
6. W. Kemp, OrganicSpectroscopy, 3rd MacMillon, 1994.
7. J.R. Dyer, ApplicationsofAbsorptionSpectroscopyofOrganicCompounds, Prentice Hall, 1965.
8. Y.R. Sharma , Elementary Organic Spectroscopy – Principles and Chemical applications, S.Chand,1992.
9. P.S.Kalsi, Spectroscopy of Organic Compounds.
10. Clegg,W., Crystal structure determination, Oxford University press , New York,1998.
11. Stout. G. H. Jenson, L.H.X-ray structure determination: A Practical guide, John wiley and sons publication. New York, 1989.
12. Glusker, J.P, Trueblood, K.N. Crystal Structure Analysis: A. Primer, Oxford university Press, New York, 1972.
13. Web Pages; Cambridge Structural Database(CSD)- - http://www.ccdc.cam.ac.uk/products/csd
14. Protein Data Bank (PDB) -http://www.rcsb.org/pdb/home/home.do

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Sl.No. | | Subject Code: | P16CH3C11

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER III – CORE COURSE – XI

(For the candidates admitted from the year 2016-2017 onwards)

PHYSICAL CHEMISTRY - II

CSO-1	To gain the knowledge of quantum mechanics
CSO-2	To study the applications of 1D, 2D and 3D Schrodinger wave equation
CSO-3	To learn the MO theory of hetero diatomic molecules
CSO-4	To construct the character tables of C_{2V} and C_{3V} point groups
CSO-5	Applications of Group theory

UNIT I-Quantum Chemistry I

Success of quantum theory and failure of classical mechanics-black body radiation-photoelectric effect. Comptom effect and atomic spectra. Formulation of quantum mechanics-the wave nature of sub-atomic particles-wave particle dualism-Heisenberg's uncertainty principle- Schordinger wave equation.

Concept of operators-sums and products of operators-commutator-linear and non-linear operators-Hermitian and Hamiltonian operators-Deriving operators for energy and angular momentum from known operators-Eigen values and eigen functions-postulates of quantum mechanics-physical interpretation of wave function-orthogonality and normalization theorems.

UNIT II-Quantum Chemistry II

Applications of wave mechanics-Schrodinger wave equation to free particle-particle in a one dimensional box-particle in a three dimensional cubic and rectangular box-degeneracy.

One dimensional harmonic oscillator-classical treatment of simple linear harmonic oscillator and its limitations-quantum mechanical treatment-complete solutions for linear harmonic oscillator- Hermite polynomial and orthogonality-Normalized solution and energy values. Rigid rotator-rigid rotator as a model for a rotating diatomic molecule-solutions.

UNIT II-Quantum Chemistry III

Solving of Schrodinger equation for the H-atom (or H-like species)-energy levels. Atomic orbitals and their shapes-electron spin and Pauli's exclusion principle.-approximation methods-need for approximation methods-Perturbation theory (I order only)-application to H-like atoms-Variation method-Application to helium atom- Molecular orbital theory-LCAO-MO treatment-MO theory of simple heterodiatomic molecules like HF, CO and NO.

Unit – IV Basics of Group Theory

Definition of a mathematical group and its properties – group multiplication table - cyclic groups-subgroups - classes – symmetry elements - symmetry operations – classes of symmetry operations - classification of molecular point groups. Matrix representations of symmetry operations- representation of groups-reducible and irreducible representations. The Great Orthogonality theorem and its consequences-character tables – construction of character tables for C_{2v} and C_{3v} point groups.

Unit – V Applications of Group Theory in Chemistry

Group theory and quantum mechanics – direct product - wave function as bases for irreducible representation – spectral transition probabilities-Symmetry Adapted Linear Combinations (SALC)-projection operators and their use to construct SALC-Huckel approximation-concept of hybridization-secular determinant – symmetry factoring of secular equations-electronic spectra- selection rule-electronic transition in formaldehyde- vibrational spectra – normal modes of vibration - selection rules – mutual exclusion principle-IR and Raman activity of fundamentals in CO_2 and H_2O.

REFERENCES

1. Introductory Quantum Chemistry, A.K. Chandra, Tata McGraw-Hill Publishing Company, 4th edn., 1994.
2. Quantum Chemistry, R.K. Prasad, Wiley Eastern, New Delhi, 1992.
3. Introductory Quantum Mechanics, Y.R. Waghmare, Eurasia Publishing House, New Delhi,1989.
4. Fundamentals of Quantum Chemistry, Anandaraman, MacMillan, India, 2001
5. F.A. Cotton, Chemical Applications of Group Theory, 3rd edn., Wiley-Interscience Publications, 2006.
6. P.K. Bhattacharya, G r o u p Theory and Its Chemical Applications, Himalayan Publishing house, 1986.
7. V. Ramakrishnan and M.S. Gopinathan, Group Theory in Chemistry, Vishal Publications,1998.

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Sl. No.: | Subject Code: P16CH3C12P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER III – CORE COURSE – XII

(For the candidates admitted from the year 2016-2017 onwards)

PHYSICAL CHEMISTRY PRACTICAL – I

CSO-1	To calculate the energy of activation for a reaction
CSO-2	To construct the three dimensional phase diagram for a system

Any ten experiments (to be decided by the course teacher) out of the following experiments.

a. Kinetics- Acid hydrolysis of ester- Comparison of strengths of acids.

b. Kinetics- acid hydrolysis of Ester- Determination of energy of activation (Ea).

c. Kinetics- Saponification of Ester- Determination of Ea by conductometry.

d. Kinetics- Persulphate- Iodine reaction- Determination of order, effective of ionic strength on rate constant.

e. Determination of molecular weight of substance by Transition Temperature method.

f. Determination of molecular weight of substances by Rast method.

g. Determination of Critical Solution Temperature (CST) of phenol- water system and effect of impurity on CST.

h. Study of phase diagram of two components forming a simple eutectic. i. Study of phase diagram of two compounds forming a compound.

j. Study of phase diagram of three components system.

k. Determination of molecular weight of substances by cryoscopy.

l. Determination of integral and differential heat of solutions by colorimetry. m. Polymerization- Rate of polymerization of acrylamide.

n. Distribution law- Study of Iodine- Iodine equilibrium.

o. Distribution law- Study of association of benzoic acid in benzene.

p. Adsorption- Oxalic acid/Acetic acid on charcoal using freundlich isotherm.

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GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER III – ELECTIVE COURSE – III

(For the candidates admitted from the year 2016-2017 onwards)

POLYMER CHEMISTRY

CSO-1	Understanding the types of polymerisation
CSO-2	To study about the polymerization techniques
CSO-3	Analysis and testing of polymers and its characterization
CSO-4	Knowledge in structure and properties of polymers
CSO-5	Basic idea about commercial polymers

Unit I - Types and Chemistry of Polymerization

Classification of polymers, Types of polymerization – addition, free radical, ionic and coordination polymerization – Zigler-Natta, Stereo regular polymerization, Condensation polymerization – Mechanism and Kinetics of polymerization – degree of polymerization – kinetic chain length – factors affecting chain polymerization- inhibition and retardation – Carother's equation.

Unit II - Copolymerization and Polymerization Techniques

Types of copolymers- ideal, alternating, block and graft copolymer – Types of copolymerization – Free radical copolymerization –polycondensation – copolymer equation – significance – monomer and radical reactivity – Q-e scheme - Determination of monomer reactivity ratio – Mayo-Lewis and Fineman Ross methods – block and graft copolymerization – methods of preparation and mechanism.

Unit III - Polymer Characteristics and Characterization

Types of degradation – thermal, mechanical and photodegradations – management of plastics in the environment.

The concept of number average and weight averages. Molecular weight methods - Molecular weight distribution, separation of polymers – precipitation and analytical methods – determination of molecular weights – Osmotic pressure, light scattering and viscosity methods.

Analysis and testing of polymers- physical / mechanical and chemical analysis of polymers – spectroscopic methods, x-ray diffraction study.

Unit IV - Structure, Properties and Fabrication of Polymers

Morphology and order in crystalline polymers – configurations of polymer chain –types of stereo isomerism in polymer – tacticity (eg. Mono and disubstitute polyethylene, polypropylene, polybutadiene) significance of stereoregularity.

Polymer structure and physical properties – crystalline melting point Tm – melting points of homogeneous series – effect of chain flexibility and heat of fusion. The glass transition temperature, Tg-relationship between Tm and Tg, effects of molecular weight, chemical structure, property requirements and polymer utilization. Fabrications of polymers – Moulding, casting and spinning polymers.

Unit V - Chemistry Commercial Polymers and Polymer Additives

Organic polymers polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins. Dendrimers – Types and applications.

Inorganic polymers – silicon polymers, glass, poly (organo phosphazenes) polymers, Basic concept of conducting polymers, liquid crystal polymer, biopolymer and biomedical polymer.

Polymer additives: Fillers, plasticizers, colourants, auto oxidants, fire retardants and thermal stabilizers – polymer blends and composites.

References

1. Text book of polymer science, F.W. Billmeyer Jr. 3rd edition, Wiley, India 2007.
2. Polymer science, V.R. Gowarikar, N.V. Viswanathan, New age international, 2003.
3. Principles of polymerization, George odian, 4th edition, John wiley and sons, 2007.
4. Polymer science and technology, Goel R. Fried, Prentice – Hall of India, New delhi, 2000.
5. Polymer science and technology of plastics and rubbers, P. Ghosh, Tata McGraw-Hill, New delhi, 1998.
6. Introductory polymer chemistry, G.S. Misra, Wiley eastern Ltd., 1993.

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Sl.No. | Subject Code : P16CH4C13P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER IV – CORE COURSE – XIII

(For the candidates admitted from the year 2016-2017 onwards)

PHYSICAL CHEMISTRY PRACTICAL – II

CSO-1	Determine the strength of redox, acid-alkali by potential measurements
CSO-2	Verification of Onsager, Oswald dilution law by conductance measurements

Any ten experiments (to be decided by the course teacher) out of the following experiments

a. Conductometry – Acid – alkali titrations.
b. Conductometry – Precipitation titrations.
c. Conductometry – Displacement titrations.
d. Conductometry – Determination of dissociation constant of weak acids.
e. Conductometry – solubility product of sparingly soluble silver salts.
f. Verification or Onsager equation – conductivity method.
g. Determination of degree of hydrolysis and hydrolysis constant of a substance.
h. Potentiometric titrations – Acidic alkali titrations.
i. Potentiometric titrations – Precipitation titrations.
j. Potentiometric titrations – Redox titrations.
k. Potentiometry – Determination of dissociation constant of weak acids.
l. Potentiometry – Determination of activity and activity coefficient of ions.
m. Potentiometry – Determination of activity and activity coefficient of ions.
n. pH titration of ortho-phosphoric acid.
o. To determine the relative strength of two acids by conductance measurements.
p. To determine the pH of a buffer solution using a quinhydrone electrode.

Reference books (practical I and II)

1. J.B Yadav, “Advanced Practical Physical Chemistry”, 20th edn. GOEL publishing House, Krishna Pakashan Media Ltd., (2001).
2. Findlay’s “Practical Physical Chemistry” Revised and edited by B. P. Levitt 9th ed., Longman, London, 1985.
3. J. N. Gurtur and R. K. Kappor, “Advanced Experimental Chemistry”, Vol.I. Chand & Co., Ltd, New Delhi.

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Sl. No.: Subject Code:P16CH4C14

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER IV – CORE COURSE – XIV

(For the candidates admitted from the year 2016-2017 onwards)

PHYSICAL METHODS IN CHEMISTRY –II

CSO-1	To explain the vibrational and Raman spectroscopy
CSO-2	Applications of simple coordination compounds using Electronic spectroscopy
CSO-3	To study the theory of EPR spectroscopy and its magnetic properties
CSO-4	To understand the interpretation and applications to inorganic compounds by NMR spectroscopy
CSO-5	To learns the principle of MRI

UNIT- I

Vibrational and Rotational Spectroscopy

Vibrational spectroscopy – classical description of molecular vibrations, the classical harmonic oscillator, quantum mechanics of molecular vibration, vibrational selection rules, anharmonic vibrations and Morse oscillator, bond dissociation energies and Birge-Sponer plots, calculation of force constants from vibrational spectrum, isotopic shift, rotational structure in vibrational spectra of diatomic molecules, vibrational selection rules, vibration of polyatomic molecules, normal modes, characteristic group vibrational energies, hydrogen bonds in IR spectra.

Raman Spectroscopy – description of Raman scattering, Rayleigh scattering, Stokes and anti- Stokes scattering , polarizability of the molecules, Placzek theory, selction rules for rotational Raman spectra of diatomic molecules, rotational Raman spectra, vibrational Raman spectra, Raman spectra of polyatomic molecules.

UNIT- II

Electronic Spectroscopy

Microstates, terms and energy levels for d1 – d9 ions in cubic and square fields– intensity of bands – group theoretical approach to selection rules – effect of distortion and spin-orbit coupling on spectra – evaluation of 10Dq and β for octahedral complexes of cobalt and nickel – applications to simple coordination compounds – charge transfer spectra – electronic spectra of $[Ru(bipy)3]^{2+}$.

Optical rotatory dispersion and circular dichroism and magnetic circular dichroism – applications to metal complexes

UNIT- III

EPR Spectroscopy and Magnetic properties

Theory of EPR spectroscopy – spin densities and McConnell relationship – factors affecting the magnitude of g and A tensors in metal species – zero-field splitting and Kramers degeneracy – spectra of V(II), Mn(II), Fe(II), Co(II), Ni(II) and Cu(II) complexes – applications of EPR to a few biological molecules containing Cu(II) and Fe(III) ions.

Magnetic properties – types of magnetism – dia-, para-, ferro- and antiferro-magnetism – magnetic properties of free ions – first-order Zeeman effect – second-order Zeeman effect – states KT – states<<<KT – determination of magnetic moments and their applications to the elucidation of structures of inorganic compounds – temperature independent paramagnetism – magnetic properties of lanthanides and actinides – spin crossover in coordination compounds.

UNIT -IV:

NMR Spectroscopy

Examples for different spin systems – chemical shifts and coupling constants (spin-spin coupling) involving different nuclei (^{1}H, ^{19}F, ^{31}P, ^{13}C) interpretation and applications to inorganic compounds – Effect of quadrupolar nuclei (^{2}H, ^{10}B, ^{11}B) on the H NMR spectra.

Mossbauer Spectroscopy

Isomer shifts – quadrupole splitting – magnetic interactions – applications to iron and tin compounds. NQR spectroscopy – characteristics of quadrupolar nucleus – effects of field gradient and magnetic field upon quadrupolar energy levels – NQR transitions – applications of NQR spectroscopy. UNIT-V

Magnetic Resonance Imaging

Introduction to Magnetic Resonance- Principles of Spatial encoding in Magnetic Resonance- application of magnetic field gradients – Larmor frequency as a function of position – frequency encoding – the generation of profiles in NMR and ESR experiments run in the presence of gradients. 3D Fourier imaging, Echo Planar Imaging. Material and in vivo applications.

REFERENCES

1. R. S. Drago, Physical Methods in Inorganic Chemistry; Affiliated East-West Press Pvt. Ltd., New Delhi, 2012.
2. R. S. Drago, Physical Methods in Chemistry; Saunders College Publications, Philadelphia, 1992.
3. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 6th Ed., Wiley-Eastern Company, New Delhi, 1999.
4. P. J. Wheatley, The Determination of Molecular Structure; 2nd Ed., Dover Publications, Mineola, 1981.
5. G. J. Leigh, N. Winterton, Modern Coordination Chemistry; Royal Society of Chemistry, UK, 2002.
6. E. A. V. Ebsworth, Structural Methods in Inorganic Chemistry; 3rd Ed., ELBS, Great Britain, 1987.
7. W. Kemp, Organic Spectroscopy; 3rd Ed., Palgrave, New York, 2011.
8. J. R. Dyer, Applications of Absorption Spectroscopy of Organic Compounds, PHI Learning, New Delhi, 2009.
9. Y. R. Sharma, Elementary Organic Spectroscopy – Principles and Chemical Applications; S. Chand and Co., New Delhi, 1992.
10. P. S. Kalsi, Spectroscopy of Organic Compounds; 6th Ed., New Age International Publishers, New Delhi, 2004.
11. P.T. Callaghan, Principles of NMR Microscopy, Oxford (1991/1994)
12. R. Kimmich, NMR Tomography, Diffusometry, Relaxometry, Springer(1997)

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Sl. No.: Subject Code: P16CH4E4

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER IV – ELECTIVE COURSE – IV

(For the candidates admitted from the year 2016-2017 onwards)

ANALYTICAL CHEMISTRY

CSO-1	To gain the knowledge of literature survey using digital, Scopus etc
CSO-2	To understand the principle, instrumentation and applications of AAS and FES
CSO-3	Knowledge in TGA, DSC and DTA
CSO-4	To study the principles of polarographic and Amperometry
CSO-5	Basic principles of electrogrametry and coloumetry

UNIT –I - Literature Survey

Print: Sources of information – Primary, Secondary, Tertiary sources – Journals – Journal abbreviations – Abstracts – Current titles – Reviews – Monographs – Dictionaries – Textbooks – Current contents – Introduction to Chemical Abstracts and Beilstein – Subject Index, Substance Index, Author Index, Formula Index and other Indices with examples.

Digital: Web resources – E-Journal – Journal access – TOC alerts – Hot articles – Citation index – Impact factor – H-Index – E-Consortium – UGC infonet – E-Books – Internet discussion groups and communities – Blogs – Preprint server – Search engines, Scirus, Google Scholar, ChemIndustry, Wiki – Databases, ChemSpider, ScienceDirect, SciFinder, Scopus.

Unit-II Spectrophotometry

Atomic absorption spectrophotometry (AAS)-principle, instrumentation and applications, types of interferences. Flame emission spectroscopy (FES)-theory, instrumentation and applications-Difference between AAS and FES. Inductively coupled plasma atomic emission spectroscopy (ICEP-AES)-principle and applications.

Unit-III Radiochemical and Thermal Methods of Analysis

Isotopic dilution methods - neutron activation analysis – Radiometric titrations - applications-principles, instrumentations and applications of thermogravimetry, Differential thermal analysis and differential scanning calorimetry-thermograms of calcium oxalate monohydrate and copper sulphate pentahydrate

Unit-IV Electroanalytical Techniques I

Polarography-principle-diffusion current-polarographic maxima-Ilkovic equation- Half wave potential-applications. Pulse voltammetry. Cyclic voltammetry- principle and simple analytical applications-interpretation of cyclic voltammogram

Amperometry - principles and applications – types of amperometric titrations with examples-comparison with other titration methods.

Unit-V Electroanalytical Techniques II

Basic principles of electrogravimetry-procedure-Coulometry-principle-coulometry at controlled potential-coulometry at constant current-coulometric titrations-advantages and applications.

Anodic stripping voltammetry-principle and applications-ion selective electrodes-principle and applications.

References

1. Instrumental methods of analysis, H,W. Willard, L.I. Merrit, J.J.A. Dean and F.A. Settle, CBS publishers, 1983.
2. Instrumental methods of analysis, Skoog and West, Saunders College Publications, 1992.
3. Instrumental methods of chemical analysis, B.K. Sharma, Goel publishing House, 19th Edn, 2000.
4. Electrochemical Methods, Fundamentals and Applications, A.J. Bard and L.R. Faulkner, John Wiley & Sons, 2nd edn., 2001.

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Sl. No.: | Subject Code: P16CH4E5

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER IV – ELECTIVE COURSE – V

(For the candidates admitted from the year 2016-2017 onwards)

GREEN CHEMISTRY

CSO-1	To understand the principles of green chemistry
CSO-2	To learns the addition and condensation reaction
CSO-3	To gain the knowledge in oxidation and reduction reactions
CSO-4	Explain the naming reaction synthesis
CSO-5	To study about sonication reactions

UNIT I: Introduction to Green Chemistry

Introduction to green chemistry – twelve principles of green chemistry – planning a green synthesis in a chemical laboratory – evaluating the type of reaction involved – rearrangement, addition, substitution, elimination and pericyclic reactions.

Selection of appropriate solvent – aqueous phase reaction – reactions in ionic liquids – organic synthesis in solid state – solid supported organic synthesis – selection of starting materials – use of protecting group – use of catalyst – use of microwaves and sonication.

UNIT II: Addition and Condensation Reactions

Addition reactions – Michael addition in [aqueous medium and solid state] – Diels-Alder reactions in aqueous phase.

Condensation reactions – Aldol condensation of aldehydes with nitroalkanes and nitriles – Aldol condensation in solid phase – benzoin condensation under catalytic conditions – applications.

UNIT III: Oxidation and Reduction Reactions

Oxidation reactions – Baeyer-Villiger oxidation in aqueous phase and solid state – enzymatic Baeyer-Villiger oxidation.

Reduction reactions – Clemmensen reduction – mechanism – limitations – applications

UNIT IV: Phase-Transfer Catalyst Reactions

Phase-transfer catalyst reactions – Heck reaction – Michael addition reaction – oxidation of toluene to benzoic acid – Reimer-Tiemann reaction – Baker-Venkataraman synthesis – Williamson ether synthesis – Dozen reaction.

UNIT – V: Sonication Reactions

Sonication reactions – Barbier reaction – Reformatsky reaction – Simmons-Smith reaction – Strecker synthesis – Ullmann coupling reaction – Wurtz reaction – Bouveault reaction.

REFERENCES

1. V. K. Ahluwalia, Green Chemistry; 2nd Ed., Ane Books Pvt Ltd., New Delhi, 2016. [UNIT- I, II, III, IV, V]
2. P. T. Anastas and J. C. Warner, Green chemistry Theory and Practice; Oxford University Press, New York, 2005. [Unit-I]
3. V. K. Ahluwalia and K. Agarwal, Organic Synthesis, Special Techniques; 2nd Ed., Narosa Publishing House, New Delhi, 2007. [Unit-I]

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Sl. No.: | | Subject Code: | P16CH4PW |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc., - CHEMISTRY – SEMESTER – IV – PROJECT WORK

(For the candidates admitted from the year 2016-2017 onwards)

	PROJECT WORK	
SL.	Area of Work	Maximum Marks
1.	PROJECT WORK:	
	(i) Plan of the Project	20
	(ii) Execution of the plan / Collection of data / Organization of materials/ Fabrication Experimental study / Hypothesis, Testing etc., and Presentation of the report.	45
	(iii) Individual Initiative	15
2.	VIVA VOCE EXAMINATION	20
	TOTAL	100

PASSING MINIMUM – 50 MARKS

CHAIRMAN –BOS COE