RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)

THANJAVUR – 613 005

(Accredited by NAAC – B^{++})

M.Sc., CHEMISTRY - SYLLABUS

(Under Choice Based Credit System - CBCS)
For Candidates admitted from the year 2015 – 16 onwards

Finalized (for the I to IV semester) in the
BOARD OF STUDIES MEETING HELD ON 26.09.2014
&

APPROVED BY THE ACADEMIC COUNCIL ON _____

PG & RESEARCH DEPARTMENT OF CHEMISTRY

RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS), THANJAVUR-5

CBCS PATTERN FOR ALL P.G COURSES

SUBJECT: CHEMISTRY

(Applicable to the Candidates admitted from the Academic Year 2015 – 2016 onwards)

PART	CODE	COURSE	TITLE	HRS / WEEK	MARKS		TOTAL	CREDIT
					IA	AE		
SEMESTER – I								
III	**RR1PCH1**	CC 1	Organic Chemistry I	6	25	75	100	5
III	**RR1PCH2**	CC 2	Inorganic Chemistry I	6	25	75	100	5
III	**RR1PCHP1**	CC 3	Organic Practical I **(6 Hrs)**	6	***40***	***60***	100	5
III	**RR1PCHP2**	CC 4	Inorganic Practical I **(6 Hrs)**	6	***40***	***60***	100	5
III	**RR1PCHEL1**	EC - 1	Analytical Chemistry	6	25	75	100	4
TOTAL				**30**	**155**	**345**	**500**	**24**
SEMESTER – II								
III	**RR2PCH3**	CC 5	Physical Chemistry I	6	25	75	100	5
III	**RR2PCH4**	CC 6	Organic Chemistry II	6	25	75	100	5
III	**RR2PCHP3**	CC 7	Organic Practical II **(6 Hrs)**	6	***40***	***60***	100	5
III	**RR2PCHP4**	CC 8	Inorganic Practical II **(6 Hrs)**	6	***40***	***60***	100	5
III	**RR2PCHEL2**	EC - 2	Inorganic Chemistry II	6	25	75	100	4
TOTAL				**30**	**155**	**345**	**500**	**24**
SEMESTER – III								
III	**RR3PCH5**	CC 9	Physical Chemistry II	6	25	75	100	5
III	**RR3PCH6**	CC 10	Organic Chemistry III	6	25	75	100	5
III	**RR3PCH7**	CC 11	Inorganic Chemistry III	6	25	75	100	5
III	**RR4PCHP5**	CC 12	Physical Practical I (Non Electrical) **(6 Hrs)**	6	**40**	**60**	100	5
III	**RR3PCHEL3**	EC - 3	Industrial Chemistry	6	25	75	100	4
TOTAL				**30**	**100**	**300**	**400**	**24**
SEMESTER – IV								
III	**RR4PCHP6**	CC 13	Physical Practical II (Electrical) **(6 Hrs)**	6	***40***	***60***	100	5
III	**RR4PCHPW**	CC 14	Project Work	12	25	75	100	5
III	**RR4PCHEL4**	EC - 4	Physical Chemistry - III	6	25	75	100	4
III	**RR4PCHEL5**	EC - 5	Nano and Computational Chemistry	6	25	75	100	4
TOTAL				**30**	**155**	**345**	**500**	**18**
GRAND TOTAL				**120**	**565**	**1335**	**1900**	**90**

NO. OF PAPERS		CREDIT
Core Courses	**14 (each 5 credits)**	**70**
Elective Courses	**05 (each 4 credits)**	**20**
TOTAL	**19**	**90**

QUESTION PAPER PATTERN

(FOR ALL THE THEORY PAPERS)

TIME: 3 HOURS *MAX. MARKS: 75*

PART A: Answer ALL the TEN Questions (10 x 2 = 20)

Two questions from each unit (without choice).

Each question Carries 2 marks = 20

PART B: Answer ALL the FIVE Questions (5 x 5 = 25)

One "EITHER OR" questions from each unit

(Internal Choice)

Each question carries 5 marks = 25

PART C: Answer any THREE Questions (3 x 10 = 30)

One question from each unit.
Each question carries 10 marks. = 30
(The candidate has to answer any
Three questions out of the
Five questions)

TOTAL MARKS = 75

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – I (Major Theory)

Credits	: 5	**Code: RR1PCH1**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – I

(For students admitted from 2015 onwards)

Organic Chemistry – I

UNIT - I

Nomenclature of organic compounds- Naming of linear and branched alkanes, alkenes, polynes and alkynes with and without functional groups by IUPAC nomenclature- aromatic and hetero aromatic systems- nomenclature of heterocycles having not more than two hetero atoms such as oxygen, nitrogen and sulphur- nomenclature of alicyclic, bicyclic and tricyclic compounds.

Reactive intermediates: free radicals-carbenes, nitrenes, -carbanions- carbonations and arynes-generation, stability, structure and reactivity-nonclassical carbocations.

Electronic effects: inductive effect, resonance effect, hyperconjugation (Baker-Nathan effect)-hydrogen bonding(inter and intra molecular).

UNIT - II

Organic stereo-chemistry I : Optical isomerism: principles of symmetry- concept of chirality- optical purity - elements of symmetry and chirality- Newmann, Sawhorse, Fisher and flying wedge notations- represntation and inter-conversions.-types of molecules exhibiting optical activity- configurational nomenclature- D and L, & R-S nomenclature- of acyclic and cyclic chiral compounds- stereo chemistry of allenes and spirenes- biphenyls (atropisomerism)- stereochemistry of ansa compounds- cyclophanes and trans cyclo alkenes- definition of terms like prochirality, enantiotopic and diastereotopic groups / faces- asymmetric synthesis-Cram's rule.

UNIT - III

Organic stereochemistry II :Geometrical isomerism: Eand Z nomenclature- determination of configuration of the geometrical isomers.

Configuration of cyclic and bicyclic ring systems: Cis and trans nomenclature of three, four, five six membered substituted cyclic systems-configuration of cyclohexane- mono and di substituted cyclohexanes- decalins.

Dynamic stereo chemistry : Quantitative correlation between conformation and reactivity-Winstein,Eliel equation- Curtin-Hammet principle- conformation, reactivity and mechanism of cyclic systems- saponification of an ester, esterification of an alcohol, chromic acid oxidation of cyclohexanols- neighboring group participation, deammination of 2-amino cyclohexanol- stereo specific and stereoselective reactions.

UNIT - IV

Methods of determing reaction mechanism: Thermodynamic and kinetic aspects of organic reactions-energy profie diagrams- intermediate versus transition states.isotope effects-kinetic and non-kinetic methods of determination of reaction mechanism- product analysis and its importance- cross over experiments- isotopic labeling studies- stereochemical studies ,substituent effects.

Correlation analysis: Linear free energy relations- Hammet equation, significance of sigma and rho- applications- Taft equation- Swain,Scott, Grunwald-Winstein equations- their applications-classification os solvents.

UNIT - V

Natural products: Carbohydrates-polysaccharides-structure of starch, and cellulose, configuration of carbohydrates- photosynthesis.

Peptides and proteins: Naturally occurring amino acids – their classifications – acid-base properties and their importance – primary, secondary, tertiary and quaternary structures of proteins – protection of N-terminal and C-terminal groups of proteins – synthesis of peptides, Merifield's solid state peptide synthesis – structure elucidation of oxytocin, biosynthesis of proteins.

Nucleic acids: chemistry of nucleic acids- structure of DNA, properties, biological implications of DNA, replication of DNA- structure of RNA- types of RNA- their functions – determining the base sequence of DNA.

Antibiotics: structural elucidation and synthesis of penicillin, streptomycin- cephalosporin C and chloramphenicol. Structure activity relationship in chloramphenicol.

References:

1. R. Panico, WH. Powell, L. Jean, C.Richer, A Guide of IUPAC Nomenclature of Organic Compounds, 1993.
2. R.S. Cahn and O.C. Dermer, Introduction to Chemical Nomenclature, 5th Edn., Butterworths, 1997.
3. J. March, "Advanced Organic Chemistry : Reactions, Mechanisms and Structure",4th ed., Wiley, 1992.
4. R.K. Bansal, "Organic Reaction Mechanisms", Tata McGraw Hill, 1975.
5. P. S. Kalsi, "Organic Reactions and their Mechanisms", New Age International Publishers.
6. E.L.Eliel, "Spectrochemistry of Carbon Compounds", McGraw Hill, 1962.
7. D. Nasipuri, Stereochemistry of Organic Compounds.
8. I.L. Finar, "Organic Chemistry", Vol.II, 5 th ed., ELBS 1975.
9. R.T. Morrison and R.N.Boyd, "Organic Chemistry", 6 th ed., Allyn and Eacon,
10. F.A. Carey and R.J. Sunberg, "Advanced Organic Chemistry, Parts A & B, Plenum, 1984.

O.P. Agarwal, Chemistry of Organic Natural Products, Vol. I & II, Goel Publications, 1997.

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – II (Major Theory)

Credits	: 5	**Code: RR1PCH2**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – I

(For students admitted from 2015 onwards)

Inorganic Chemistry – I

UNIT - I

Acids and bases: Bronsted and Lewis acids and bases, pH, pka acid-base concept. Non-protonic concepts of acid base reactions – Lux concept solvent ion theory of acids bases-liquid ammonia, acetic acid as solvents - bromine trifluoride, dinitrogen tetroxide, liquid hydrogen fluoride acid solvents – classification of acids and bases as hard or soft - acid base strength, hardness and softness – symbiosis - theoretical basis of hardness and softness - electronegativity and hardness , softness.

Inorganic chains, rings and clusters: chains - catenation - hetero-catenation- silicate minerals (names and structures only) - intercalation chemistry - talc, mucovite, structures only.

Isopoly anions: basic building units of vanadates – molybdates - tungstate ions - heteropoly anions - structures only.

Rings- phosphazenes - structure-craio and Paddock model -Dewar model

UNIT - II

Ionic bond and crystal structure: radius ratio rules - calculation of some limiting radius ratio values for C.N. 3.(planar triangle), C.N. 4 (tetrahedral), C.N. 6 (octahedral).

Classification of ionic structures: AX, AX_2, AX_3, types - AX type, ZnS, NaCl, CsCl, - structures only - AX_2 type - Fluorite, rutile, beta crystobalite, structures only - layer structure CdI2, nickel arsenide, structure - lattice energy-Born. Lande equation – derivation - important points arising from Born. Lande equation - Schotky defect - Frenkel defect - explanation and calculation of no. of defects form per cm cube - metal excess defect F centres and interstitial ions - metal deficiency defects - positive ions absent - extra interstitial negative ions.

UNIT - III

NQR Spectroscopy: Characteristics of Quadrupolar nucleus – Effect of field gradient and magnetic field upon Quadrupolar energy levels, NQR Transitions – Applications of NQR Spectroscopy.

Artificial Radioactivity: Nuclear reactions – transmutation - stripping and pick up, fission, fusion, spallation, fragmentation reactions - scattering reactions - nuclear cross section – Q value - Nuclear reactors - charged particle accelerators - neutron sources - gamma ray and x-ray sources - applications of nuclear science in agriculture and biology - neutron activation and isotope dilution analysis.

UNIT - IV

Medicinal bioinorganic chemistry: bio-inorganic chemistry of toxic metals - lead, cadmium, mercury, aluminum, thorium, iron, copper, plutonium -detoxification by metal chelation, - drugs which act by binding the metal sites of metallo-enzymes - Radiation risks - medical benefits - natural and man made radio isotopes - bio inorganic chemistry of radio pharmaceuticals - technetium.

UNIT - V

Extraction and uses of metals: metallurgy of Zr, Ge, Be, Th, preparation and uses of their compounds - metal clusters - binuclear clusters - structure of Re_2Cl_8, qualitative MO diagrams for dinuclear rhenium and molybdenum complexes to explain the strength of quadraupole bond – cluster bonding models – Wade and Luhar.

References:

1. M. C. Day and J. Selbin, "Theoretical Inorganic Chemistry",Affiliated East West Press Pvt. Ltd. 2 nd ed., 1985.
2. F.A.Cotton and G.Wilkinson, " Advanced Inorganic Chemistry", 4 th ed., A Wiley - Interscience Publication, John –Wiley & Sons, USA.
3. J.E. Huheey, "Inorganic Chemistry" 3 rd . ed., Harper & Row publisher, Singapore. 4.
4. S. Glasstone, "Source Book on Atomic Energy", D.Van Nostrand, New York 1967 (Affiliated East-West Press, New Delhi 1969)
5. G.Friedlander, J.W. Kennedy and J.Miller, "Nuclear and Radiochemistry, 3 rd Ed., Wiley Interscience Publications, John Wiley & Sons, New York.
6. J.D. Lee, A New Concise Inorganic Chemistry, 4th Ed., ELBS, 1995.
7. B. Douglas, D. H. McDaniel and J. J. Alexander, "Concepts and Models of Inorganic Chemistry", 2 nd ed., John Wiley & Sons, New York.
8. Purcell and Kotz, "Inorganic Chemistry", Saunders Golden Sunburst Series, W. B. Saunders Company, Philadelphia.
9. R. W. Hay, "Bioinorganic Chemistry".
10. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, Panima Publishing Company, New Delhi, 1997.
11. W. Kaim and B. Schewederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley & Sons, New York, USA.

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – III (Major Practical)

Credits : 5 **Code: RR1PCHP1**

Hours / Week : 6

Medium of Instruction : English

SEMESTER – I

(For students admitted from 2015 onwards)

Organic Practical – I

1. **Qualitative analysis of organic mixture**

    a) Pilot separation
    b) bulk separation
    c) analyses
    d) derivtisation
    e) determination of m.p or b.p of derivatives

2. **Single stage preparation of organic compounds**

    a) Nitration : methyl m- nitrobenzoate from methyl benzoate.
    b) Addition : Benzophenone oxime from benzophenone
    c) Chlorination cum diazotization : o-chloro benzoic acid from anthranilic acid
    d) Oxidation: p-benzoquinone from hydroquinone
    e) Diazotisation; Phenly azo 2-naphthol from aniline

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015– 16

Core Course – IV (Major Practical)

Credits : 5 **Code: RR1PCHP2**

Hours / Week : 6

Medium of Instruction : English

SEMESTER – I

(For students admitted from 2015 onwards)

Inorganic Practical – I

1. **Semi-micro qualitative analysis** of

   A mixture containing two common and two rare cations

2. **Colorimetric estimation** of

   a) Copper,
   b) Ferric,
   c) Nickel,
   d) Chromium,
   e) Manganese using photo electric colorimeter.

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Elective Course – I (Elective Chemistry)

Credits	: 4	**Code: RR1PCHEL1**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – I

(For students admitted from 2015 onwards)

Analytical Chemistry

UNIT – 1

DATA ANALYSIS

Accuracy and Precision – Significant Figures – Rounding Off – determinate Errors – Indeterminate errors – sways of Expressing accuracy – standard deviation – Propagation of errors – The Confidence Limit – Tests of Significance – Rejection of a Result:The Q Test – Statistics for Small Data Sets – Linear Least squares – The Correlation Coefficients

UNIT – II

ELECTRO ANALYTICAL METHODS

Polarography: Principle, experimental technique – dropping mercury electrode – Residual, migration and diffusion currents – Half-wave potential – Ilkovic equation – Analytical applications of polorography – Differential pulse polorography, cyclic voltametry – principle, experimental setup – application – Amperometric titration – principle and types – Titration between $Pb^{2+}$and $K_2Cr_2O_7$. electrogravimetry – theory of electrolysis, experimental set up diagram- applications – ion selective electrodes: principle and applications – DSC: Principle and applications – TMA: Principle and applications

UNIT – III

THERMALMETHODS OF ANALYSIS

Thermal methods of analysis – Principle – instrumentation –methods of obtaining thermogram- TGA curves for $AgNO_3$, $CuSO_4$, CaC_2O_4,H_2O Differential thermal analysis – Principle – instrumentation – DTA curves for the above compounds. Factors influencing DTA- applications of DTA. Study of Organic reactions, Decomposition of complexes, Thermometric titration.

UNIT – IV

OPTICAL METHODS

Colorimetry - Laws of colorimetry – mono chromators, detectors, instrumentation and applications – Estimation of Cr in steel - Biochemical analysis of urea, sugar and cholesterol.

Flame photometry: Principle, Instrumentation and applications.

Turbidimetry and Nephelometry: principle and choice between two techniques – Instrumentation and applications.

Fluorometry and phosphometry: principle, instrumentation and applications - Refractrometry and polarimetry:principle, instrumentation and applications.

UNIT – V

CHROMATOGRAPHY AND SOME ADVANCED TECHNIQUES

Principles, classification (adsorption, partition, column, thin layer and paper chromatographic techniques) and applications - Ion exchange, solvent extraction, GC, HPLC techniques and applications, types of column, detectors applications – GC-MS and HPLC-MS – electrophoresis-Principle, techniques and applications.

AAS, ICP-ES, ICP-MS – electron microscvope: SEM, TEM and AFM – principle and applications.

Rederences:

1. F.W. Fifield and D. Kealey, "Principles and practice of Analytical Chemistry", Blackwell Publishing,Fifthh Edition, 2000.
2. J.S. Fritz and G.H. Scheink, "Quantitative Analytical Chemistry",Allyn and Bacon, Inc., Boston, Fifth Edition, 1987.
3. G.D. Christian,"Analytical Chemistry", John Wiley and Sons, Inc., Fifth Edition, 1994.
4. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, "Fundamentals of Analytical Chemistry", Thomson-Brooks.Cole, Eigth Edition, 2004.
5. H.H. Willard, L.L Merritt, J.A. Dean and F.A. Settle, Jr., CBS Publishers and Distributors, New Delhi, Sixth Edition, 1986.

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – V (Phy. Chemistry)

Credits	: 5	**Code: RR2PCH3**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – II

(For students admitted from 2015 onwards)

Physical Chemistry - I

UNIT – I

Quantum chemistry I: Time independent Schrödinger's wave equation (SWE) from classical wave equation and de Broglie relationship – elementary ideas about time dependent SWE – Postulates of Quantum Mechanics - Operator Algebra – linear, non-linear and ladder operators – Hermitian operators(definition and theorems) and their properties – proof of Hermitian nature of linear, angular, position and Hamiltonian operators – eigenfunctions and eigenvalues – normalization and orthogonality – principle of superposition – commutation relations of linear and angular momentum operators – average/expectation values.

Application of SWE to model systems - particle in one and three dimensional boxes – quantum numbers, distortion of the box, zeropoint energy and uncertainty principle – orthogonality and normalization – finite potential barrier and tunneling.

UNIT – II

Molecular Spectroscopy – I :

Microwave spectroscopy : Theory of linear, symmetric and asymmetric top molecules.

Infrared spectroscopy : vibrational spectra – selection rules-harmonic and un-harmonic oscillators – (fundamental absorption, first and second overtones, hot bands etc.) – rotation-vibration spectra of diatomic molecules (P,Q,R branches; breakdown of Born-Oppenheimer approximation), selection rules and transitions for rigid-rotor-harmonic oscillator model – relative intensities – coupling of rotation and vibration – linear and symmetric top molecules (parallel and perpendicular bands) – influence of rotation on the rotation of polyatomic molecules Fourier Transform IR spectrometry.

Raman spectroscopy: Raman effect-elastic and inelastic scattering- selection rules-pure rotational Raman Spectra (linear, spherical top, symmetric top and asymmetric top molecules) – vibrational Raman spectra – polarization of light and Raman effect – comparison of IR and Raman spectra – simple molecules – mutual exclusion principle – Fermi resonance – laser Raman spectroscopy.

UNIT – III

Classical thermodynamics: thermodynamics of systems of variable composition – partial molar quantities and additive rules – chemical potential –relationship between partial molar quantities – Gibbs-Duhem equation- calculation of partial molar quantities from experimental data – thermodynamic properties of real gases – fugacity - definition, calculation (real gases) – and variation of fugacity with temperature, pressure and composition (Duhem-Margules equation) – activity and activity coefficient definition – standard states – colligative properties and the activity of the solute

– experimental determination of activity and activity coefficients of non-electrolytes – activities in electrolytic solutions – determination of activity coefficient of electrolytes by freezing point method.

Phase rule : phase rule to three component systems – systems of three liquids – solid-liquid systems - (eutectic systems and two salts and water.)

UNIT – IV

Chemical kinetics I :

Theories of reaction rates (Bimolecular collision theory, absolute reaction rate theory ARRT) – significance of reaction coordinate – potential energy surfaces – kinetic isotopic effect – opposing, parallel and consecutive reactions – the Hinshelwood theory – Kassel, Rice and Ramsperger (KRR) theory – KRRM method – the Slater treatment – Principle of microscopic reversibility – Steady state approximation – chain reactions – thermal and photochemical reactions between hydrogen and halogens. Gas phase auto-oxidation, explosions and hydrogen- oxygen reaction.

Factors influencing reaction rates in solutions – application of ARRT to solution kinetics – effect of solvents – double and single sphere model – effect of ionic strength – influence of pressure on rates in solution – significance of volume of activation – homogeneous catalysis – acid-base catalysis Brønsted relation.

UNIT – V

Fast reaction techniques : Flow methods (continuous and stopped flow methods) – relaxation methods (T and P jump methods) – pulse techniques (flash photolysis, shock tube method) – molecular beam method – half life time method.

Photochemistry: Photophysical processes in electronically excited molecules – Jablonski diagram – Stern-Volmer Equation and its applications – experimental techniques in photochemistry – chemical actinometers – lasers and their applications. Fluorescence,Quenching- static and dynamic quenching Stern-Volmer Plot – linear and non-linear plots – Reasons fordeviation in stern-volmer plot. Excited state life time ( ) – definition of life time estimation of life time ( ) by time – correlated single photon counting technique.

Basic aspects of photocatalysis – principle – application of semiconductor nano particles in environmental remediation and solar energy conversion (photo splitting of water and dye sensitized solar cells – basic aspects for both)

References:

1. R.K. Prasad, Quantum Chemistry, New Age International Ltd,
2. A.K. Chandra, " Introductory Quantum Chemistry", 4 th ed,. Tata MCGraw Hill (1994)
3. D.A. Mcquarrie, "Quantum Chemistry", University Science Books (1998)
4. F.L.Pillar."Elementary Quantum Chemistry", McGraw Hill (1968)
5. J.P.Lowe, "Quantum Chemistry", Academic Press (1978).
6. I.N.Levine, "Quantum Chemistry", Allyn and Bacon (1983).
7. P.W.Atkins, "Molecular Quantum mechanics", Clarendon Press New York(1973).
8. K.J. Laidler, "Chemical Kinetics",2 nd ed., Tata McGraw Hill (1975).
9. A.A. Frost and R.G.Pearson, "Kinetics and Mechanisms", John Wiley & Sons, New York, 1953.

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – VI (Org. Chemistry)

Credits : 5 **Code: RR2PCH4**

Hours / Week : 6

Medium of Instruction : English

SEMESTER – II

(For students admitted from 2015 onwards)

Organic Chemistry - II

UNIT – I

Aliphatic nucleophilic substitution : SN^1, SN^2, and SNi mechanisms-effect of substrate structure, leaving group, attacking nucleophile and solvent-neighboring group participation— substitution in allylic carbons and reactivity-ambident nucleophiles.

Elimination reactions : E_1, E_2, E_1cb and Ei mechanisms- stereo chemistry of eliminations – Hoffman and Saytzeff rules-competition between elimination and substitution reactions-Chugaev reaction-dehydration of alcohols-dehydrohalogenation-Hoffman degradation-cope elimination-Bredt's rule

Aliphatic electrophilic substitution : SE_1,SE_2, and SEi mechanism-effect of substrate structure, leaving groups, attacking electrophiles and solvent-Stark-Enamine reaction-decarboxilation of aliphatic acids- halogenation of aldehydes and ketones.

UNIT - II

Aromatic compounds : Elements of aromaticity-Huckel and Craig's rule-Effects of aromaticity on bond lengths- ring currents-Nonbenzanoid aromatic compounds- aromatic character in three, five,seven and eight membered rings-anti-aromaticity-system with 2,4,6,8 and10 electron system.-annulenes and avonones-alternant and non-alternant hydrocarbons,

Aromatic electrophilic substitution : Aromatic ion mechanism-orientation and reactivity-nitration, halogenation, friedel Craft reaction-Gattermann, Kolbe-Schmidt , Reimer-Tiemann, Hauben-Hoesch reactions.

Aromatic Nucleophilic substitution: SN^{Ar}, SN^1, benzyne, SRN1 mechanisms – effect of sustrate structure, leaving groups, attacking nucleophiles and solvents – selected reactions – Zeigler alkylation, Chichibabin reaction- reactions involving diazonium group as leaving group – cine substitution – von Richter reaction.

UNIT - III

Addition reactions : Addition to carbon –carbon multiple bonds-electrophilic addition-nucleophilic free radical additions, orientation and reactivity- Birch reduction,hydroxylation, hydroboration, epoxidation, Diels-Alder reaction, Michael addition, ozonolysis, carbenes and their addition to double bonds.

Addition to carbonyl groups : Mannich , crossed cannizzaro , Stobbe , Benzoin , formation of ketenes , openauer oxidation , MPV reduction , Darzen's glycidic ester condensation , wittig reactions.

UNIT - IV

Molecular rearrangements: Mechanism of the following- wagner Meerwin-Dienone phenol- Wolf-Lozson-Schmidt-Bayer Villiger-Stevens-Wittig-Favoraski rearrangements.

Reagents in Organic Syntheses: Complex metl hydrides – LiAlH4, NaBH4, tri tert-butoxyaluminium hydride, Gilman's reagents, Lithium dimethylcuprate, lithium di-isopropyl amide, dicyclohexylcarbodiimides, 1,3-dithianestrimethyl silyl odide, DDZ, SeO_3 – phase transfer catalyst, Crown ethers and Merrifield resins.

UNIT - V

Natural products : Isolation and detection of natural products – a brief outline to carotenoids, flavonoids and anthocynins with one example each (structural elucidation not needed)

Terpenes: structural elucidation , Medicinal values and synthesis of α-pinene, camphor and zingiberene – biosyntheses of terpenes.

Alkaloids: Structural elucidation, medicinal values and synthesis of quinine, reserpine, morphine, cinchonine and papavarine – biosyntheses of alkaloids.

Vitamins: Physiological importance – structural elucidation of vitamins –B_1, B_2, B_6, E and K.

References:

1. J. March, "Advanced Organic Chemistry : Reactions, Mechanisms and Structure",4th ed., Wiley, 1992.
2. R.K. Bansal, "Organic Reaction Mechanisms", Tata McGraw Hill, 1975.
3. P. S. Kalsi, "Organic Reactions and their Mechanisms", New Age International Publishers.
4. I.L. Finar, "Organic Chemistry", Vol.II, 5 th ed., ELBS 1975.
5. O.P. Agarwal, Chemistry of Organic Natural Products, Vol. I & II, Goel Publications, 1997.
6. F.A. Carey and R.J. Sunberg, "Advanced Organic Chemistry, Parts A & B, Plenum, 1984.
7. T.H. Lowry and K.S.Richardson, "Mechanism and Theory in Organic Chemistry",Harper and Row, 1976.

Question Paper Pattern

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Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – VII (Major Practical)

Credits : 5 **Code: RR2PCHP3**

Hours / Week : 6

Medium of Instruction : English

SEMESTER – II

(For students admitted from 2015 onwards)

Organic Practical – II

1. **Quantitative analysis of organic compounds**
   Phenol,
   aniline
   ketone
   glucose
   sapanification value of oils
   iodine value of oils

2. **Double stage Preparation:**

   a) p- bromo acetanilide from aniline
   b) acetyl salycilic acid from methyl salicylate
   c) 1,3,5 tribromo benzene from aniline
   d) p-nitro aniline from acetanilide
   e) benzylic acid from benzoin by rearrangement
   f) benzanilde from benzophenone by rearrangement
   g) p- amino benzoic acid from p-nitro aniline
      p-bromo aniline from acetanilide
   h) m- nitro aniline from nitro benzene
      i) 1,2,4-triacetoxybenzenefromhydroquinone
         (oxidation plus acetylation)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – VIII (Major Practical)

Credits : 5 **Code: RR2PCHP4**

Hours / Week : 6

Medium of Instruction : English

SEMESTER – II

(For students admitted from 2015 onwards)

Inorganic Practical – II

1. **Titrimetry and gravimetry**

   only mixtures of solutions should be given for estimation.

   i. Cu vol, Ni grav
   ii. Cu vol, Zn grav
   iii. Fe vol, Zn grav
   iv. Fe vol, Ni grav
   v. Zn vol, Cu grav

2. **Preparation of the following complexes**

   i. Tetrammine copper(ii) sulphate.
   ii. Potassium tri oxalato chromate (iii)
   iii. Hexa thiourea Lead (ii) nitrate
   iv. Potassium tri oxalato aluminate(iii)
   v. Tristhiourea copper(I) chloride
   vi. Tris thiourea copper(ii) sulphate

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Elective Course – II (Elective Chemistry)

Credits	: 4	**Code: RR2PCHEL2**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – II

(For students admitted from 2015 onwards)

Inorganic Chemistry - II

UNIT-1

Coordination chemistry: Nomenclature of mono and poly nuclear complexes – crystal field theory – shapes of d orbitals – splitting of d orbitals in octahedral symmetry- CFSE-strong field and weak field splitting-calculation of CFSE for dn system- splitting in tetrahedral symmetry-only weak field splitting-reasons- tetragonal symmetry- differences between tetrahedral and tetragonal symmetry- John Teller distortion- splitting pattern in trigonal, squreplanar, trigonal bipyramidal, square pyramidal, cubic symmetries. Factors affecting the magnitude of splitting (10Dq) -oxidation state of the metal ion, nature of the metal ion, number and geometry of the ligands, nature of the ligands – Spectrochemical studies, Jorgenson relation, evidences for CFT. Magnetic properties, computation of lattice energies, enthalpies of hydration, stability of particular oxidation states. Site preferences in sofuels-

M.O. theory -octahedral, tetrahedral and square planar complexes. Pi bonding and M.O theory- ligands having filled and empty pi bonds-effect on 10 Dq.- evidences for Pi bonding.- X-ray crystallography.- IR, Photoelectron spectroscopy, Nephelauxiticeffect.-angular overlap model.

UNIT - II

Stability of coordination compounds : Detection of compound formation in solution. Stability constants—stepwise and overall formation constants—ph metric, polorographic, photometric methods of determining formation constants. Factors affecting stabilities—statistical and chelate effects.

Kinetics and mechanisms of reactions in solutions

Labile and inert complexes - ligand displacement reactions- hydrolysis , aquation in octahedral and square planar complexes – trans effect- electron transfer reactions – complementary and non complementary types – inner sphere and outer sphere processes – isomerisation and racemisation.- reactions of coordinated ligands temolate effect and synthesis of macrocyclic ligands

UNIT - III

Photochemistry of coordination compounds : Photochemical reactions of coordination and organometallic compounds—photo oxidation-photoreduction-photo substitution-photo isomerisation reactions-complexes of pi acceptor ligands- carbonyls-18 electron rule-application to the structure of carbonyls-(mono and polynuclear)-application of IR to identify the terminal and bridging CO- preparation and properties of carbonyls- $Ni(CO)_4$, $Fe(CO)_9$, $Cr(CO)_6$, $Re_2(CO)_{10}$, -Carbonylate anions-carbonyl hydrides- isolobal fragments-nitrosyl complexes preparation-bridging and terminal nitrosyls-bent and linear nitrosyls,-dinitrogen complexes.

UNIT - IV

Carbon pi-donor complexes : Synthesis, structure and bonding in olefins, acetylenes and allyl complexes-metallocenes-molecular orbitals ofmetallocenes-catalysis by organonetallic compounds –hydrogenation and hydroformylation of olefins-oxidation of olefins to aldehydes and ketones- polymerisation of allenes – cyclo oligomerisation of acetylene-Fischer- Tropsch synthesis.

UNIT - V

Bio-inorganic chemistry : Bio membranes- membrane transport- sodium and potassium pumps – crown ethers , cryptands , spherands , chemotherapy – Pt complexes in cancerotherapy – Cis platin and its mode of action – cytotoxic compounds of other metals – Gold containing drugs as anti Rheumatic agents and their mode of action – Lithium in psycho Pharmacological.

Reference:

1. Shriver, Atkins and Langford Inorganic Chemistry, ELBS, 1994
2. F.A.Cotton and G.Wilkinson, " Advanced Inorganic Chemistry", 4 th ed., A Wiley - Interscience Publication, John –Wiley & Sons, USA.
3. J.E. Huheey, "Inorganic Chemistry" 3 rd . ed., Harper & Row publisher, Singapore. 4.
4. S. Glasstone, "Source Book on Atomic Energy", D.Van Nostrand, New York 1967 (Affiliated East-West Press, New Delhi 1969)
5. Purcell and Kotz, "Inorganic Chemistry", Saunders Golden Sunburst Series, W. B. Saunders Company, Philadelphia
6. W. Kaim and B. Schewederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley & Sons, New York, USA.
7. R. W. Hay, "Bioinorganic Chemistry".
8. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, Panima Publishing Company, New Delhi, 1997.
9. A.W. Adamson and P. D. Fleischauer, "Concepts of Inorganic Photochemistry", Wiley, New York, 1975.

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – IX (Chemistry)

Credits	: 5	**Code: RR3PCH5**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – III

(For students admitted from 2015 onwards)

Physical Chemistry - II

UNIT-I

Group theory : Elements of Group theory – properties of group and subgroup – classes – group multiplication tables – isomorphism groups – symmetry elements and symmetry operations – inter relations among symmetry operations – generators – point groups of molecules – matrix representation theory – consequences of great orthogonality theorem and construction of character tables(C_{2v} and C_{3v}) – characters, reducible and irreducble representations – direct products and correlation tables.

Application of group theory: to IR, Raman (for non-linear molecules; polarization ratio – number of Raman polarized lines) and Electronic spectra – projection operators – SALC procedure – evaluation of energies and HMO calculations for systems like ethylene butadiene and planar monocyclic aromatic compounds – hybridization schemes of sigma orbitals.

UNIT - II

Quantum Chemistry – II

Application os SWE to: Simple Harmonic Oscillator (SHO) – Hermite polynomial, Eigenfunctions and Eigenvalues – rigid rotator with free axis (SWE in polar coordinates, separation of angular functions and their solutions, Legendre and associated Legendre polynomials, degeneracy of rotational states) – selection rules for rotational and vibrational transitions – Bohr correspondence principle – hydrogen and hydrogen like atoms (separation of angular and radial wave equations and solution to radial equation, Lagurre and associated Lagurrre polynomials, quantum numbers, shapes and nodal properties of orbitals, space quantization and electron spin) – SWE to many electron atoms and molecules – Born-Oppenheimer approximation – one electron orbitals – the antisymmetry or Pauli's exclusion principle and Slater Determinant (ground state helium atom)

UNIT - III

Molecular spectroscopy I: Introductory aspects : Interaction of radiation with molecules – Einstein and transition probabilities – basics of selection rules – epresentation of spectra – the width and intensity of spectral transitions – oscillator strength – Fourier Transform spectroscopy.

Photoelectron Spectroscopy: Basic Principles – Koopman's theorem – UPES, XPES (ESCA and Auger Spectrosciopy) – valence and core binding analysis, examples and applications of ESCA with two examples

UNIT – IV

Statistical Mechanics I:

Calculation of thermodynamic probability of a system – difference between thermodynamic and statistical probability – ensembles, phase space – ergodic hypothesis – definition of micro and macro states – different methods of counting micro and macro states – distinguishable and indistinguishable particles – classical statistics – derivation of Boltzmann distribution law.

Partition Functions : Translational, rotational, vibrational and electronic partition functions – calculation of internal energy, enthalpy, entropy and other thermodynamic functions – application of partition function to mono and diatomic molecules.

UNIT – V

Chemical Kinetics - II

Surface Phenomena: Adsorption and free energy reaction relation at inter-phase – physisorption and chemisorption – potential energy diagram – Lannard- Jones plot – BET isotherm – surface area determination – adsorption from solution – Gibbs adsorption isotherm- solid liquid inter face- wetting and contact angle- solid gas interfaces- soluble and insoluble films.

Electrical phenomenon at interfaces including Electro kinetic – micelles and reverse micelles – solublisation – micro-emulsion or micelliar emulsions.

Role of surfaces in catalysis: semiconductor catalysis – n and p type surfaces – kinetic s of surface reactions involving adsorbed species – Langmuir- Hinshelwood mechanism of bimolecular reaction – Langmuir-Rideal mechanism of bimolecular reaction – Rideal-Eler mechanism.

References:

1. R.K. Prasad, Quantum Chemistry, New Age International Ltd,
2. A.K. Chandra, " Introductory Quantum Chemistry", 4 th ed,. Tata MCGraw Hill (1994)
3. D.A. Mcquarrie, "Quantum Chemistry", University Science Books (1998)
4. F.L.Pillar."Elementary Quantum Chemistry", McGraw Hill (1968)
5. J.P.Lowe, "Quantum Chemistry", Academic Press (1978).
6. I.N.Levine, "Quantum Chemistry", Allyn and Bacon (1983).
7. P.W.Atkins, "Molecular Quantum mechanics", Clarendon Press New York (1973).
8. K.J. Laidler, "Chemical Kinetics",2 nd ed., Tata McGraw Hill (1975).
9. A.A. Frost and R.G.Pearson, "Kinetics and Mechanisms", John Wiley & Sons, New York, 1953.
10. I.Amdur and G.G. Hammes, "Chemical Kinetics Principles and Selected Topics", McGraw Hill, New York, (1966).
11. 1K.K. Rohatgi Mukherjee ,"Fundamentals of Photochemistry", Wiley Eastern Ltd, New Delhi (1978).
12. G. Hughes, "Radiation Chemistry", Oxford Chemistry Series, Clarendon Press, (1973).

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – X (Chemistry)

Credits	: 5	**Code: RR3PCH6**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – III

(For students admitted from 2015 onwards)

Organic Chemistry - III

UNIT - I

Organic photochemistry: Funtamental concepts- Jablonski diagram- energy transfer characteristics of photo reactions and photo oxidation- photoreactions of ketones and enones- Norrish type I and II- reactions- photo-chemistry of alkenes, dienes and aromatic compounds- photosensitization- photo additions- Barten reaction- Patterno Buchi reaction.

Pericyclic reactions: Concerted reactions- stereochemistry- orbital symmetry and correlation diagram- Frotier molecular orbital approach- Woodward- Hoffmann rules- electrocyclic reactions- cycloaddition reactions- selection rules- zigmatropic rearrangements- selection rules with simple molecules- 1.3 and 1.5 hydrogen shifts- Cope and Claisen rearrangements.

UNIT - II

Ultraviolet and visible Spectroscopy: Basic principles of electronic transitions- correlation of energy change with electronic transitions- instrumentation and sample handling techniques- Applications of UV- visible spectroscopy- Woodward Fishr Scott rules- applications to conjucated dienes, trienes and polyenes- unsaturated carbonyl compounds- conjugated cyclic ketones- actophenones – benzene and its substituted derivatives- othr aromatic hydrocarbons- hetecyclic systems- differentiation of position isomers- stereo-chemical factors affecting electronic spectra of biphenyl and binaphthyls- cis trans isomers- angular distortion- cross conjugation.

Infrared Spectroscopy : Instrumentation and sampling techniques- types of stretching and bending vibrations- characteristic group frequencies- both internal and external- quantitative studies- organic structure determination, finger print region - identification of functional groups- hydrogen bonding, intermolecular and intra molecular-conformational aspects in cyclic 1,2 diols and 1,3 diols- transannular interactions in UV and IR – determination of reaction rates and mechanisms of reactions involving IR and UV spectroscopy- (basic aspects)

UNIT - III

Proton nmr spectrometry: Chemical and magnetic non-equivalence- chemical shift- coupling constant- first and second order proton spin- spin interaction- dependence of j on dihedral angles- vicinal and geminal coupling constants- karplus equation- long range coupling constants- influence of stereo chemical factors on chemical shift of protons- simplification of complex spectra- double resonance techniques- shift reagents- chemical spin decoupling of rapidly exchangeable protons- OH, COOH, SH, NH 2- an elementary treatment of NOE phenomenon- to techniques- COSY- MOSCY,- RGSY.

^{13}C NMR spectroscopy: Basic principles- ft.nmr- explanation- broad band decoupling- off resonance decoupling- calculation of chemical shifts for simple aliphatic and aromatic compounds- conformation and chemical shift correlation- peak assignments- importance of NOE phenomenon in 13c nmr spectroscopy.

UNIT - IV

Mass spectroscopy: Basic principles- resolutions- EI and CI methods- base peak- isotopic peaks- metastable peaks- parent peaks- determination of molecular formula- recognition of molecular ion peak- fragmentation - general rules- nitrogen rule- pattern of fragmentation of various classes of compounds- Mc Lafferty rearrangement- importance of metastable peks

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 delocalised system- applications to organic free radicals.

Optical rotatory 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- comparison between ORD and CD -their inter relationships.

UNIT - V

Steroids: Classification- structural elucidation and synthesis of cholesterol(synthesis not required) vitamin D,progesterone, stigmasterol. Structure and biological activity of ergosterol, , equilenin, androsterone, oestrone and cortisone. classification and functions of prostoglandins- conformations of steroids- biosynthesis of cholesterol.

Heterocyclics: Synthesis and reactions of azoles- pyrazole, imidazole, oxazole, and thiazloe- synthesis and reactions of azepine, oxazine, thiazine, pyridazine pyrimidine, and pyrazine.

Reference:

1. P.M. Silverstein, F. X. Wester, "Spectroscopic Identification of Organic Compounds", 6 th ed., Wiley 1998.
2. J.R.Dyer, "Applications of Absorption Spectroscopy of Organic Compounds", Prentice Hall, 1965.
3. W.Kemp, Organic Spectroscopy, ELBS, 1991.
4. Y.R.Sharma, Elementary Organic Spectroscopy- Principles and Chemical Applications, S.Chand, 1992
5. P.S. Kalsi, Spectroscopy of Organic Compounds,
6. C.H.Depuy and O.S.Chapman, Molecular Reactions and Photochemistry, Prentice Hall, 1975.
7. M.G.Arora, Organic Photochemistry and Pericyclic Reactions.
8. I.L.Finar, Organic Chemistry Vol II, ELBS, 5th Edn., 1975

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – XI (Chemistry)

Credits : 5 **Code: RR3PCH7**

Hours / Week : 6

Medium of Instruction : English

SEMESTER – III

(For students admitted from 2016 onwards)

Inorganic Chemistry - III

UNIT- I

Electronic spectroscopy: electron configuration- terms, states and micro states- derivation of term symbols- (p^2,d^2)- arranging various terms according to their energies- spectroscopic terms- effect of inter-electronic repulsion and spin- orbit coupling- Racah parameters, D and RS coupling and ij coupling- selection rules and the breakdown of selection rules- group theoretical explanation- splitting of orbitals in octahedral field –hole formalism- ground states of free ions for dn systems- oh and Td systems and the corresponding energy level diagrams- mixing of orbitals- orgel diagram, characteristics- prediction and assignment of transitions for dn weak field cases. Tanang-Sugano diagrams- characteristics- prediction and assignment of transition for weak field and strong field – d^n systems- band intensity, band width, band shapes- factors affecting these – distortion and spin orbit coupling- calculation of B and 10D for simple complexes- charge transfer spectra.

UNIT - II

NMR spectroscopy; chemical shifts and coupling constants (spin,spin coupling involving different nuclei ^{1}H, ^{31}P, ^{13}C)- interpretations and applications to inorganic compounds- effect of quadrupolar nuclei (^{2}H, ^{10}B, ^{11}B) on the proton nmr.- NMR of paramagnetic molecules-isotopic shifts, contact and pseudo- contact interactions-lanthanide shift reagents- stereo chemistry of non-rigid molecules.

EPR spectroscopy: basic principles- characteristics of the hyperfine splitting selection rules-hyperfine splittings in various structures, bis (salicylaldimine copperII)-factors affecting the magnitude of g values. – g values of transition metal ions-dependence on spin orbit coupling- and crystal field effects- three conditions(I)spin orbit coupling,>> than crystal field (ii)strength of crystal field braking the spin orbit coupling (iii) very large crystal field , Ni II octahedral complexes, Cu II in a tetrahedral field, -zero field splitting- Krammers degeneracy- magnitude of zero field splitting and signal- effective spins mixing of states and zero field splitting- line width, in solid state EPR- spin lattice relaxation- spin, spin relaxation- exchange processes- effect of distortion- T2, Ag, Eg, ground terms- g(parallel) and g(perpendicular) dependence on 10 Dq, ,lamda, k- calculation of g s-alpha^2,beta^2 and G parameters from EPR and information obtained from them.

UNIT - III

IR and Raman spectroscopy: Combined uses of IR and Raman spectroscopy in the structural elucidation of simple molecules likeH_2O, ClF_3, NO_3' ion, ClO_3' ion, - effect of coordination on ligand vibrations- uses of group vibrations in in the structural elcidation of metal complexes of urea, thiourea, cyanide, thiocyanate, nitrate, sulphate, and dimethyl sulphoxid e- effect of isotopic substitution on the vibrational spectra of molecules- vib. Spectra of metal carbonyls with reference to the nature of bonding, geometry, nd number of C-O stretching vibrations- group theoretical treatment.-

Lanthanides : co-ordination compounds of lanthanides-spectral and magnetic properties-
Actinides : synthesis of elements- magnetic and spectral characteristics of actinides.
Transition Metals: Magnetic properties of transition metal compounds

UNIT- IV

Mossbauer Spectroscopy: Mossbauer transition and Dopler effect- isomer shift- quadropole effect of magnetic field on spectra- simple applications – iron and tin compounds.

Solid State-differences between point group and space group- scew axis-glide planes-crystal symmetry elements-crystal classes- crystal systems- unit cell- bravis lattice- asymmetric unit space group- equivalent positions-relationship between molecular symmetry and crystallographic symmetry- basic concepts, the concept of reciprocal lattice and its application- x-ray diffraction by single crystal- structure factor- systematic absence- determination of space groups-heavy atom method- neutron diffraction, elementary treatment- comparison with x-ray diffraction- electron diffraction , basic principles.

UNIT - V

Diagramatic presentation of potential data: Latimer diagrams- Frost diagrams-base latemer diagrams- pour basic diagrams- effect of compound formation on potentials-

Bio-inorganic chemistry: Ion pumps-oxygen transport- enzyme applications, acid catalysis-oxalo acetate decarboxylase,carboxypeptidase-redox catalysis- iron sulphur proteins-nonheme iron-cytochromes of the electron transport chain- cytochrome P-450 enzymes.

Reference:

1. R.S. Drago, "Physical Methods in Inorganic Chemistry", 3 rd Ed., Wiley Eastern, Company
2. Shriver, Atkins and Langford Inorganic Chemistry, ELBS, 1994
3. F.A.Cotton and G.Wilkinson, " Advanced Inorganic Chemistry", 4 th ed., A Wiley - Interscience Publication, John –Wiley & Sons, USA.
4. J.E. Huheey, "Inorganic Chemistry" 3 rd . ed., Harper & Row publisher, Singapore. A.F.A. Kettle, Coordination Compounds, ELBS,
5. B.N. Figgis, Introduction to Ligand Field Theory, Wiley-Eastern, New Delhi.
6. E.A.V.Ebsworth, "Structural Methods in Inorganic Chemistry", 3 rd ed., ELBS, Great Britain, 1987.
7. D.N. Sathyanarayana, Vibrational Spectroscopy, New Age International Publs., 1996.
8. K. Nakamoto, Infrared and raman Spectra of Inorganic and Coordination Compounds,sJohn-Wiley & sons, 1978

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – XII (Practical Chemistry)

Credits : 4 **Code: RR4PCHP5**

Hours / Week : 9

Medium of Instruction : English

SEMESTER – III

(For students admitted from 2015 onwards)

Physical Practical - I (Non – Electrical)

Non-electrical – Practical - I

1. Kinetics – Acid Hydrolysis of Ester – Comparison of strengths of acids.
2. Kinetics – Acid Hydrolysis of Ester – Determination of Energy of Activation (Ea).
3. Kinetics – Saponification of Ester .
4. Kinetics – Persulphate – Iodide Reaction – Determination of order, effect of Ionic strength on rate constant.
5. Distribution Law – Study of iodine – Iodide equilibrium.
6. Distribution Law – Study of Association of Benzoic Acid in Benzene.
7. Adsorption – oxalic Acid\ Acetic Acid on charcoal using Freundlich isotherm.
8. Determination of molecular weight of substances by cryoscopy.
9. Determination of Molecular weight of substances by Transition Temperature method.
10. Determination of molecular weight of substances by Rast method.
11. Determination of critical solution temperature(CST) of phenol water system and effect of impurity on SCT.
12. Determination of integral and differential heat of solutions by colorimetry.
13. Study of phase diagram of two components forming simple eutectic.
14. Study of phase diagram of two components forming a compound.
15. Study of phase diagram of three components system (Acetic acid, Benzene, and water.
16. Kinetics – Acid Hydrolysis of Ester – Comparison of strengths of acids.
17. Kinetics – Acid Hydrolysis of Ester – Determination of Energy of Activation (Ea).
18. Kinetics – Saponification of Ester .
19. Kinetics – Persulphate – Iodide Reaction – Determination of order, effect of Ionic strength on rate constant.
20. Distribution Law – Study of iodine – Iodide equilibrium.
21. Distribution Law – Study of Association of Benzoic Acid in Benzene.
22. Adsorption – oxalic Acid\ Acetic Acid on charcoal using Freundlich isotherm.
23. Determination of molecular weight of substances by cryoscopy.
24. Determination of Molecular weight of substances by Transition Temperature method.
25. Determination of molecular weight of substances by Rast method.
26. Determination of critical solution temperature(CST) of phenol water system and effect of impurity on SCT.
27. Determination of integral and differential heat of solutions by colorimetry.
28. Study of phase diagram of two components forming simple eutectic.
29. Study of phase diagram of two components forming a compound.
30. Study of phase diagram of three components system (Acetic acid, Benzene, and water.

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Elective Course – III (Elective Chemistry)

Credits : 4 **Code: RR3PCHEL3**

Hours / Week : 6

Medium of Instruction : English

SEMESTER – III

(For students admitted from 2015 onwards)

Industrial Chemistry

UNIT – I

Basic ideas about chemical industries: Flow charts- chemical conversion – Batch versus continuous processing – chemical process economics – market survey – plant location – Research and development and its role in chemical industries.

Water in industry: pollution of water by ertilizer, detergent and pesticide industries – BOD, COD – water treatment – ion exchange, reverse osmosis and softening of hard water.

UNIT – II

Cement: Manufacture, Hot process and dry process – types – analysis of major constituents – setting of cement – reinforced concrete – cement industries in India.

Glass: types – composition – manufacture of optical glass, coloured glass and neuron absorbing glass - Fertilizers: Fertiliser industries in India – manufacture of ammonia – ammonia saltd, urea, super phosphate, triple super phosphate and potassium salts.

UNIT – III

Sugar: sugar manufacture, recovery of sugar from molasses, sugar industries in India.

Cleansing agents: Preparation of toilet and washing soaps- synthetic detergents – alkyl, aryl sulphonates, builders, additives and corrosion inhibitors - Paints and Varnishes: Primary constituents of paints – dispersion medium (solvent) – binders' pigments- oil based paints – latex paints – requirements of a good paint.

UNIT – IV

Rubber industries: Natural rubber – synthetic rubber – monomer production – synthetic rubber polymerization – butadiene, styrene co polymers – neoprene – urethane rubber.

Plastics: Manufacture – resin – manufacturing process – condensation, polymerization – polyamides – nylon 66, polyester and terelene.

UNIT – V

Coal : Origin and imporatance of coal – types – composition – coal gasification – carbonization – coal tar based chemical manufacture – coal mines in India.

Petroleum : Origin – refining – cracking – knocking – and octane number – LPG – synthetic gas and synthetic petrol.

Fuel gases : Large scale production – storage – hazards and uses of coal gas, water gas and producer gas and oil gas.

References:

1. B.N. Chakrabarthy, Industrial chemistry , Oxford & IBH publishing Co.,New delhi, 1981
2. B.K sharma industrial chemistry, geol publishing House, Meerut.
3. P.P. Singh, T.M. Joseph and R.G.Dhavale, College Industrial chemistry, Himalaya publishing House, Bombay ,4th Ed., 1983
4. R. Norrish sherve and Joseph A.Brink Jr., Chemical Process industries, Mcgraw Hill Industriak Book Company, London
5. A.C.S. Brain , Production and properties if industrial Chemicals, Reinhold, NY.

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Core Course – XIIII (Chemistry)

Credits	: 5	**Code: RR4PCH8**
Hours / Week	: 12	
Medium of Instruction	: English	

SEMESTER – IV

(For students admitted from 2015 onwards)

Applied Chemistry

UNIT - I :

Sono Chemistry

Introduction – Instrumentation – The physical aspects – Types of Sonochemical reactions – Homogeneous reactions – Heterogeneous liquid – liquid reactions – Heterogeneous solid – liquid reactions – Synthetic Application – Esterification – Saponification – Hydrolysis / Solvolysis – Substitutions – Addition reactions – Alkylations – Oxidation – Reduction – Hydroboration – Hydrosilation and hydroalkylation – Coupling reactions – Dichlorocarbene – Other Reactions – Bourgveault reaction – Cannizzaro reaction – Strecker synthesis – The Reformatsky reaction – The barbier reaction of carbonyl compounds – Condensations – Carbohydrates – formation of acetals and benzylidene derivatives of alkylaglycopyranosides

UNIT- II

Chem Informatics:

Introduction – Evaluation – History and uses – molecular modelling using computer –Basic idea - chemical information data base design and their management – data base concepts – structural languages chemical data base design Chemical information sources – chemical information researches formula searching.

Unit- III

Supramolecular Chemistry:

Introduction – molecular forces, molecular recognition - basic concepts of host - guest complexation with examples from ionophore chemistry – non-covalent interactions and organic host - guest complexes, molecular receptors for different types of molecules, design and synthesis of co receptor molecules, triangular square, rectangular supramolecules.

Unit- IV

Polymer Chemistry

Introduction - structure, classification of polymers, polymerisation methods, Importance of polymers,Molecular weight of polymers – Number average and weight average, Determination of molecular weight by osmometry, light scattering, viscosity and sedimentation methods, Kinetics of polymerisation reactions,polycondensation reactions, ionic and free radical polymerisation, copolymersation - coordination polymers,Conducting polymers.

UNIT – V –

Water Treatment

Water in industry: Pollution of water by fertilizer, detergent and pesticide industries – BOD, COD – water treatment – ion exchange, reverse osmosis and softening of hard water. Treatment of water for municipal purposes – Chemical methods of sterilization – Physical methods of sterilization – Sea water as a source of drinking water – Desalting. Electro dialysis method. Reverse osmosis method

References :

1. Chemoinformatics- A text book Johann Gasteiger, Thomas Engel Wiley – VCH Gmbh & Co., Germany
2. P.S. Kalsi & J.P Kalsi – Bioinorganic, Bioorganic & supra molecular chemistry – New Age International Publishers – 2010
3. V.R.Gowariker, N.V. Viswanathan and Jayadev Sreedhar, Polymer Science, New Age Publishers,New Delhi, 1986.
4. Charles E. Carraher, Polymer chemistry, 6th edn, Marcel Dckker, Brijbasi Art Pvt.Ltd, 2003
5. B.K. Sharma, Engineering Chemistry, Krishna Prakasan Media (P) Ltd.,1997
6. W.Kemp, Organic Spectroscopy, ELBS, 1991.
7. Y.R.Sharma, Elementary Organic Spectroscopy- Principles and Chemical Applications, S.Chand, 1992
8. P.S. Kalsi, Spectroscopy of Organic Compounds,

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

Part B – 5 X 5 = 25Answer All Questions (Either 0r type -Two questions from each unit)

Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16

Elective Course – IV (Chemistry)

Credits	: 4	**Code: RR4PCHEL4**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – IV

(For students admitted from 2015 onwards)

Physical Chemistry - III

UNIT - I

Quantum Chemistry – III

Need for approximation methods – variation method (statement, proof, sewcular equation, applications to hydrogen and helium atoms) perturnbation method for non-degenerate systems(first order corrections to eigenvalues and eigenfunctions, applications to helium atom)

Angular momentum in many electron systems (spin orbit interaction, L_S, j-j cvoupling scxhemes) – elementary idea of Hartree-Fock self-consistent field method

MO and VB treatment of hydrogen molecule (electron density, forces and their role in chemical binding) – hybridization, solving wave equation for sp, sp2 and sp3 hybrid orbitals – Huckel's molecular orbital theory and its application to ethylewne and butadiene (charge density, pi-bond order and free valence).

UNIT-II

Molecular Spectroscopy III: NMR: spin and applied magnetic field-Larmor precession-relaxation precession- PMR chemical shift- spin spin interaction (AX and A2 – spin systems in terms of spin Hamiltonian and spin product functions)- Fourier transformation NMR- multiple pulse nmr (effect of pulses, the rotating frame of reference, free induction decay FID, multiple pulse spin-spin and spin-lattice relaxation, inversion recovery) - C13 nmr- chemical exchange- evaluation of thermodynamic parameters in simple system.

ESR- spectroscopy : basic principles, zero field splitting and Kramer's degeneracy, Factors affecting the g-values - presentation of spectra-hyperfine splitting- isotopic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnel'srelationships, measurement techniques and applications.

UNIT - III

Quantum statistics: Bose- Einstein, Femi-Dirac distribution functions - comparision of them with M- statistics- Application of BE statistics to photon gas- superfluidity of liquid helium-application of FD statistics to electron gas and thermionic emission.

Heat capacities of solids- Einstein and Debye's treatments- concept of negative kelvin temperature.

Non-equilibrium thermodynamics: Theremodynamics of irreversible processes – entropy production and entropy flow in open systems – Onsagar's theory – phenomenological relations – Onsagar reciprocal relation - steady state condition – L12 = L21 with respect to (i)thermoelectricity, (ii)electro kinetic effect (iii)thermo molecular pressure difference (iv) transference number methoed

UNIT - IV

Ionics: Transport of ions in solution- Debye-Huckel theory- radius of ionic atmoshphere and its calculation - Debye-Huckel-Onsagar equation modification – asy7mmetry and electrphoretic effect – evidences for ionic atmosphere - Falkenhegen and Wien's effects.- extension to Debye Huckel Onsager theory-

Activity of ions in solution- Experimental determination- Debye-Huckel limiting law (derivation, verification and modification) - activity coefficient at higher conc- Bjerrum model.

Electrode- Electrolyte equilibrium- Nernst equation- and its limitations- equilibrium electrode potentials- classification of electrodes- concentration cells- liquid junction potentials- thermodynamic quantities from EMF data.

Electrochemical energy- Storage systems- primary and secondary batteries- fuel cells.

UNIT V

Electokinetic phenomena: Theories of electrical double layer - Electrical double layer potential- theory of multiple layers at electrode electrolyte interface- double layer capacity- ectrokinetic phenomena- zeta potential- electro osmosis- sedimentation potential

Processes at the electrodes- the rate of charge transfer- exchange current density- Butler-Volmer equation- Tafel equation-

Principles of corrosion electrochemical corrosion- construction and use of pourbaix and Evans diagram and prevention of corrosion- electrochemical oxidation and reduction.
Cyclic voltametry – principles and applications.

Reference:

1. P.W. Atkins, "Physical Chemistry", ELBS and Oxford University Press, Oxford,1983.
2. F.W. Sears, "Thermodynamics, Kinetic theory of Gases and Statistical Mechanics", 2 nd Ed., Addision Wesley, (1972).
3. S.Glasstone, "Introduction to Electrochemistry", Affiliated East-West Press, (1968).
4. J.Albery, "Electrode Kinetics", Clarendon Press, Oxford Chemical Series, (1979)
5. J.O.Bockris and A.K.N. Reddy, "Modern Electrochemistry", Vol. I & II, Plenum (1970).
6. L.I. Anthrapov, "Theroretical Electrochemistry", Mir Publishers, Moscow, (1972).
7. Glasstone, "Theoretical Chemistry", Affiliated East-West Press.
8. Gupta, Statistical Thermodynamics
9. Lee, Sears and Salinger, Kinetic Theory of Gases and Statististical Thermodynamics,

Question Paper Pattern

Maximum Marks: 75

Exam duration: Three Hours

Part A – 10 X 2 = 20 Answer All Questions (Two questions from each unit)

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Part C – 3 X 10 = 30 Answer Any THREE (One question from each unit)

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005
M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – XIII (Practical Chemistry)

Credits : 4 **Code: RR4PCHP6**

Hours / Week : 9

Medium of Instruction : English

SEMESTER – IV

(For students admitted from 2015 onwards)

Physical Practical - II (Electrical)

Electrical – Practical – II

1. Conductometry – Acid – alkali titrations.
2. Conductometry – precipitation titrations.
3. Conductometry - Displacement titrations.
4. Conductometry – Determination of dissociation constant of weak acids.
5. Conductometry – Solubility product of sparingly soluble silver salts.
6. Verification of Onsager equation – conductivity method.
7. Determination of degree of hydrolysis and hydrolysis constant of a substance.
8. Potentiometric titrations – Acid alkali titrations.
9. Potentiometric titrations – precipitation titration.
10. Potentiometric titrations – Redox Titrations.
11. Potentiometry – Determination of dissociation constant of week acids.
12. Potentiometroy – Determination of solubility of silver salts.
13. Potentiometry – Determination of activity and activity coefficients of Ions.
14. pH titration of ortho-phosphoric acid.

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Elective Course – V (Ele. Chemistry)

Credits	: 4	**Code: RR4PCHEL5**
Hours / Week	: 6	
Medium of Instruction	: English	

SEMESTER – IV

(For students admitted from 2015 onwards)

NANO AND COMPUTATIONAL CHEMISTRY

UNIT –I

What is nano –Why nano –Nanomaterials characteristic differences over bulk materials – Synthesis of nanomaterials, Bottom – up vs. top – down approaches –
RF Plasma, Chemical methods, Thermolysis, Pulse laser methods- Micro Electro Mechanical Systems[MEMS] & Nano Electro Mechanical System(NEMS)

UNIT-II

Different classes of nanomaterials- Metal and Semicondutor Nanomaterials. Quantum Dots, Wells and Wires, Characterization – Crystallography(XRD),Transmission Electron Microscopy(TEM), Scanning Microscopy (SEM,STM&AFM)

UNIT-III

Computational Chemistry – What you can do with computational chemistry, The tools of computational chemistry,Putting it all together, The philosophy of computational chemistry. The concept of the Potential Energy Surface-Perspective,Stationry Points, The Born-Oppenheimer approximation, Geometry optimization,Stationary points and normal- mode vibrations:ZPE, Symmetry.

UNIT-IV

Introduction to computers and computing- basic organization of a computer-CPU- main memory-secondary storage-I /Odevices- software- system and application software-high and low level languages- computers- algorithms and flowcharts.

Introduction to networking- computer networks-network components-hubs, switches, repeaters, routers, bridges-routers and gateways- network topologies- star, bus and ring-LAN, WAN,Intranet and Internet- worldwideweb-internet for chemists-online search of chemistry data bases- search engines for chemistry-chemweb-e-journals.

UNIT-V

Green chemistry- Need for green chemistry-12 principles-concept of atom economy: Illustration for Rearrangement, Subsitution, Addition and Elimination reactions-concept of selectivity :Chemo,Regio,Enatio and Diastereio selectivity-Green solvents :Super critical CO2, Ionic liquids, water- Solvent less processes . Green Synthesis: Adipic acid, Ibuprofen, Urethane Micro wave assisted reactions in water: Hydrolysis of benzyl chloride to benzyl alcohol, oxidation of toluene to benzoic acid.
Ultro sound assisted reaction: Esterfication, limitation of green chemistry.

References

1. **Introduction to Nanotechnology, charles P.Poole,Jr. and Frank J. Owens,Wiley,2003**
2. **I.N Levine "Quantum chemistry" 5th edition.Prentice Hall, Upper Saddle River, NJ,2000**
3. **K.N. Houk,Y.Li, and J.D. Evanseck, Angew, chem..Int.Ed,Engi.1992,31,682.**
4. **P. Atkins, "Physical chemistry",6th edition, Freeman,New York,1998,PP.830-844.**
5. **K.V. Raman,Computers in Chemistry,TMH,1993.**
6. **M. Born and J.R. Oppenheimer, Ann. Physik., 1927,84,457.**
7. **A.P. Scott and L. Radom, J.Phys.chem.,1996,100,16502.**

Question Paper Pattern

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