

RAJAH SERFOJI GOVERNMENT COLLEGE
(AUTONOMOUS)

THANJAVUR – 613 005

(Accredited by NAAC – B⁺⁺)

B.Sc., CHEMISTRY - SYLLABUS

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



**Finalized (for the I to VI Semester) in the
BOARD OF STUDIES MEETING HELD ON 26.09.2014**

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APPROVED BY THE ACADEMIC COUNCIL ON _____

PG & RESEARCH DEPARTMENT OF CHEMISTRY

RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS), THANJAVUR – 600 005**COURSE STRUCTURE FOR B.A., / B.Sc., / B.Com, / B.B.A., UNDER CBCS****U.G. PROGRAMMES – CHEMISTRY****(Applicable to the Candidates admitted from the Academic Year 2015 – 2016 onwards)**

PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT	
					IE	WE			
<i>I SEMESTER</i>									
I	RR1T1	LT	PART I Tamil – I	6	25	75	100	3	
II	RR1E1	LE	PART II English – I	6	25	75	100	3	
III	RR1CH1	CC1	Inorganic, Organic and Physical Chemistry – I	6	25	75	100	4	
III	-	CC3	Volumetric Analysis Practical - I	3	-	-	-	-	
III	RR1AZ1 / RR1AM1	Allied 1	Allied Zoology – I / Allied Maths - I	4	25	75	100	4	
III	-	Allied 3	Allied Zoology Practical – I Allied Maths - III	3	-	-	-	-	
IV	RR1VE	VE	Value Education	2	25	75	100	2	
Total				30	125	375	500	16	
<i>II SEMESTER</i>									
I	RR2T2	LT	PART I Tamil – II	6	25	75	100	3	
II	RR2E2	LE	PART II English – II	6	25	75	100	3	
III	RR2CH2	CC2	Inorganic, Organic and Physical Chemistry – II	6	25	75	100	5	
III	RR2CHP1	CC3	Volumetric Analysis Practical – I (3 Hrs)	3	40	60	100	5	
III	RR2AZ2 / RR2AM2	Allied 2	Allied Zoology – II / Allied Maths –II	4	25	75	100	4	
III	RR2AZP / RR2AM3	Allied 3	Allied Zoology Practical – I(3Hrs) Allied Maths - III	3	40/ 25	60/ 75	100	4	
IV	RR2ES	ES	Environmental Studies	2	25	75	100	2	
Total				30	205	495	700	26	

PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT	
					IE	WE			
III SEMESTER									
I	RR3T3	LT	PART I Tamil – III	6	25	75	100	3	
II	RR3E3	LE	PART II English – III	6	25	75	100	3	
III	RR3CH3	CC4	Inorganic, Organic and Physical Chemistry – III	6	25	75	100	5	
III	-	CC6	Inorganic Qualitative Analysis Practical - II	3	-	-	-	-	
III	RR3AP1	Allied 4	Allied Physics – I	4	25	75	100	4	
III	-	Allied 6	Allied Physics Practical	3	-	-	-	-	
IV	RR3SB1	SB1	Skill Based – 1	2	25	75	100	2	
Total				30	125	375	500	17	
IV SEMESTER									
I	RR4T4	LT	PART I Tamil – IV	6	25	75	100	3	
II	RR4E4	LE	PART II English – IV	6	25	75	100	3	
III	RR4CH4	CC5	Inorganic, Organic and Physical Chemistry – IV	6	25	75	100	5	
III	RR4CHP2	CC6	Inorganic Qualitative Analysis Practical - II (3 Hrs)	3	40	60	100	5	
III	RR4AP2	Allied 5	Allied Physics – II	4	25	75	100	4	
III	RR4APP	Allied 6	Allied Physics Practical (3 Hrs)	3	40	60	100	4	
IV	RR4SB2	SB2	Skill Based – 2	2	25	75	100	2	
Total				30	205	495	700	26	

PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT
					IE	WE		
V SEMESTER								
III	RR5CH5	CC7	Inorganic Chemistry – I	6	25	75	100	5
III	RR5CH6	CC8	Organic Chemistry – I	5	25	75	100	4
III	RR5CHP3	CC9	Organic Chemistry Practical – III (3 Hrs)	3	40	60	100	4
III	RR5CHEL1	MEC1	Physical Chemistry - I	5	25	75	100	4
III	RR5CHEL2	MEC2	Analytical Chemistry	5	25	75	100	4
III	RR5PHELO1	NMEC1	Domestic Electric Appliances	4	25	75	100	4
IV	RR5SB3	SB3	Skill Based – 3	2	25	75	100	2
Total				30	190	510	700	27
VI SEMESTER								
III	RR6CH7	CC10	Inorganic Chemistry – II	5	25	75	100	5
III	RR6CH8	CC11	Physical Chemistry – II	5	25	75	100	5
III	RR6CHP4	CC12	Gravimetric Analysis Practical - IV (3 Hrs)	5	40	60	100	4
III	RR6CHP5	CC13	Physical Chemistry Practical – V (3 Hrs)	5	40	60	100	4
III	RR6CHEL3	MEC3	Organic Chemistry – II	4	25	75	100	4
III	RR6ECELO2	NMEC2	Numerical Methods	4	25	75	100	4
V	RR6GS	GS	Gender Studies	2	25	75	100	1
V	RR6EA	Ext. Activities	NSS / NCC / SPORTS / RED CROSS	-	-	-	-	1
Total				30	205	495	700	28
GRAND TOTAL							3800	140

RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS), THANJAVUR – 600 005**COURSE STRUCTURE FOR B.A., / B.Sc., / B.Com, / B.B.A., UNDER CBCS****U.G. PROGRAMMES – CHEMISTRY****(Applicable to the Candidates admitted from the Academic Year 2015 – 2016 onwards)****Course Structure**

PART	COURSE TITLE	NO. OF PAPERS	TOTAL CREDITS
PART - I	TAMIL	4X3	12
PART - II	ENGLISH	4X3	12
PART - III	CORE	8X5 = 40 5X4 = 20	60
	ELECTIVES	3X4	12
	ALLIED	6X4	24
	NON MAJOR	2X4	8
PART - IV	ES,VE	2X2	4
	SKILL BASED	3X2	6
PART - V	GS	1X1	1
	EXT.ACTIVITIES	-	1
TOTAL PAPERS – 38			TOTAL CREDIT - 140

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16)
Core Course – I (Major Theory)

Credits : 3
 Hours / Week : 6
 Medium of Instruction : Both Tamil and English

Code: RR1CH1

SEMESTER – I

(For students admitted from 2015 onwards)

Inorganic, Organic and Physical chemistry – I

UNIT – I (Inorganic Chemistry)

Chemical bonding

- 1.1. Lattice energy and Born – Haber Cycle
- 1.2. Pauling and Mulliken's scales of electronegativity.
- 1.3. Polarising power and Polarisability – Partial ionic character from electronegativity – Transition from ionic to covalent character and vice-versa – Fajan's rules – concept of hard and soft acids and bases.
- 1.4. VSEPR Theory: Shapes of simple inorganic molecules (BeCl_2 , BF_3 , SiCl_4 , PCl_5 , SF_6 , IF_7 , H_2O , NH_3 , XeF_6) containing lone pair and bond pairs of electrons – Lewis structures .
- 1.5. Hydrogen bonding – Its nature, types, effect on properties.
- 1.6. Intermolecular forces – London forces and van der Waals forces.

UNIT –II (Inorganic Chemistry)

2.1. Boron Family:

Comparative study of boron family elements: Compounds of boron – diborane structure discussion – borax, boron nitride, boron carbide and borazole.

2.2. Carbon Family

- 2.2.1. Comparative study of carbon family elements and their compounds (hydrides, halides and oxides).
- 2.2.2. Chemistry of cyanogens, hydrocyanic acid, cyanic acid, thiocyanic acid, ammonium thiocyanate and carbon disulphide.
- 2.2.3. Structures of graphite, diamond and fullerene.

2.3 Volumetric Analysis :

Basic requirements of titration reaction – concentration terms – standard solutions – primary and secondary standards – types of titrimetric reactions – redox and precipitation titrations – indicators – effect of change in pH – neutralization – mixed and fluorescent indicators.

UNIT –III (Organic Chemistry)

3.1. Basic concepts in organic chemistry - catenation

- 3.1.1. Hybridization and geometry of molecules – methane, ethane, ethylene and acetylene (sigma and pi bonds, bond lengths, bond angles, bond energy)
- 3.1.2. Electron displacement effects – Inductive, inductometric, electromeric, mesomeric, resonance (localized and delocalized chemical bond), hyperconjugation and steric effects.
- 3.1.3. Cleavage of bonds – homolytic and heterolytic fission of carbon – carbon bonds.

- 3.1.4. Reaction intermediates – free radicals, carbocations and carbanions, carbenes, nitrenes and arynes – their stability.
- 3.2. Nomenclature of organic compounds – IUPAC naming of simple and substituted aliphatic, aromatic and alicyclic compounds. Priorities of functional group suffixes in polyfunctional groups.

UNIT –IV (Organic Chemistry)

- 4.1. Alkanes :
- 4.1.1. Mechanism of free radical substitution in alkanes.
- 4.1.2. Conformation of ethane and n-butane with energy diagrams – dihedral angle – torsional strain.
- 4.2. Alkenes
- 4.2.1. Properties of alkenes – electrophilic and free radical addition, addition reactions with hydrogen bromide (peroxide effect), sulphuric acid, water, hydroboration, ozonolysis, hydroxylation with KMnO_4 – allylic substitution by NBS (with mechanisms of all the above reactions)
- 4.3. Alkynes.
- 4.3.1. Acidity of alkynes, formation of acetylides, addition of water with HgSO_4 catalyst, addition of hydrogen halides and halogens, oxidation, ozonolysis and hydroboration. (with mechanisms of above reactions)
- 4.3.2. Problems and conversions

UNIT –V (Physical Chemistry)

- 5.1. Gaseous state.
- 5.1.1. The Gas constant “R” in different units - deviation from ideal behaviors - van der Waal’s equation for real gases.
- 5.1.2. Critical Phenomena – PV isotherms of real gases, critical temperature, continuity of state relation between critical constants and van der Waals constants- Determination of critical volume – the law of corresponding states – reduced equation of state.
- 5.1.3. Molecular velocities – Root mean square, average and most probable velocities (derivation from Maxwell-Boltzmann distribution equation)-Maxwell – Boltzmann distribution of molecular velocities (no derivation) - Collision number and mean free path – Collision diameter.
- 5.1.4. Preliminary idea on transport properties of gases – (Thermal conductivity, viscosity, and diffusion)

References:

1. R.D.Madan, J.S.Tiwari and G.L.Mudhara – A text book of First Year B.Sc.Chemistry – S.Chand & Co.
2. G.S.Manku – Theoretical Principles of Inorganic Chemistry Tata McGraw Hill, New Delhi.
3. Paula Yurkanis Bruice- Organic Chemistry, Prentice Hall
4. J.D.Lee , “ Concise Inorganic Chemistry “. 5 th Edition., Blackwell Science Ltd, Oxford, 2002
5. B.S. Bahl and Arun Bahl, “ Advanced Organic Chemistry ,” S .Chand and Co New Delhi.
6. B.R Puri And Sharma , “ Principles of Physical Chemistry ,”

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 = 25 Answer All Questions (Either Or 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – III (Major Practical)

Credits : 5 **Code: RR2CHP1**
 Hors / Week : 3
 Medium of Instruction : Both Tamil and English

SEMESTER – I & II

(For students admitted from 2015 onwards)

PRACTICAL – I: VOLUMETRIC ANALYSIS

(Examination at the End of Semester – II)

VOLUMETRIC ANALYSIS

I. Acidimetry And Alkalimetry

II. Permanganimetry.

1. Estimation of Ferrous iron in Mohr's salt.
2. Estimation of Ferrous and Ferric iron in a mixture.
3. Estimation of Oxalic acid.
4. Estimation of Calcium.

III. Dichrometry

5. Estimation of Ferrous Iron.
6. Estimation of Ferric Iron – by using both internal and external indicators.

IV. Iodo and Iodimetry.

7. Estimation of Copper.
8. Estimation of Potassium Dichromate.
9. Estimation of Arsenious Oxide.

V. Argentometry.

10. Estimation of Chloride (in neutral and acid media)

VI. Complexometric Titrations.

11. Estimation of Zn, Mg and Ca ions using EDTA.

Note: EDTA and acidimetry - alkalimetry experiments to be included in the END *Semester Examinations* .

Procedure writing at the beginning
 along with the principles of calculations : 05 Marks
 and equations
 Record : 05 Marks
 Practical : 50 Marks
 CIA : 25 Marks
 Total : 100 Marks

Error Based Marks for the Practical (55 Marks)

Upto 1% : 55 Marks
 1 to 2% : 45 Marks (deduce 1 mark for 0.1%)
 2 to 3% : 30 Marks (deduce 1.5 mark for 0.1%)
 3 to 4% : 10 Marks (deduce 2 marks for 0.1%)
 Above 4% : 02 Marks

For wrong Calculation deduce 5 Marks from the total marks awarded

For Shabby presentation deduce 3 marks from the total marks awarded

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – II (Major Theory)

Credits	: 5	Code: RR2CH2
Hors / Week	: 6	
Medium of Instruction	: Both Tamil and English	

SEMESTER – II

(For students admitted from 2011 onwards)

Inorganic, Organic and Physical chemistry – II

UNIT – I (Inorganic Chemistry)

- 1.1. Oxidation and reduction reactions – oxidation number concept, balancing redox equations by oxidation number method and ion-electron method – equivalent weight of oxidizing and reducing agents.
- 1.2. Halogen family – comparative study of halogens and their compounds.
 - 1.2.1. Oxides and oxy acids of halogens (structure only) – estimation of available chlorine in bleaching powder.
 - 1.2.2. Interhalogen compounds – preparation, properties and uses
 - 1.2.3. Pseudo-halogens – Preparation, properties and uses of cyanogens and thiocyanogen comparison with halogens
 - 1.2.4. Basic properties of halogens – Anomalous properties of fluorine

UNIT –II (Inorganic Chemistry)

- 2.1. Oxygen family – comparative study. Oxygen fluorides.
- 2.2. Ozone – Preparation, properties, structural elucidation and uses. Green-house effect, ozone hole and protection of ozone layer
- 2.3. Hydrogen peroxide – Preparation, properties, estimation, structure and uses.
- 2.4. Peracids of sulphur – their preparation, properties, uses and structures.
- 2.5. Thionic acids – their preparation, properties, uses and structures.
- 2.6. Sodium hyposulphite and sodium thiosulphate – Preparation, properties, uses and structures.

UNIT –III (Organic Chemistry)

- 3.1. **Dienes**
 - 3.1.1. Types of dienes – conjugated, isolated and cumulated.
 - 3.1.2. Stability and chemical reactivity – 1,2 and 1, 4 additions, kinetic and thermodynamic controls of a reaction. Diels-Alder reaction.
 - 3.1.3. Synthesis of dienes – 1, 3 Butadiene, isoprene and chloroprene.
- 3.2. **Cycloalkanes.**
 - 3.2.1. Preparation using Wurtz's reaction, Dieckmann's ring closure and reductions of aromatic hydrocarbons.
 - 3.2.2. Substitution and ring opening reactions.
 - 3.2.3. Bayer's strain theory and theory of strainless rings.
- 3.3. Problems and conversions involving the reactions of alkynes and dienes.

UNIT –IV (Physical Chemistry)**4.1. Solid state.**

- 4.1.1. Isotropic and anisotropic solids.
- 4.1.2. Nature of the solid state – seven crystal systems – Bravais lattice, unit cell, law of rational indices (Weiss indices) Miller indices, symmetry elements in crystals (for cubic system only in detail).
- 4.1.3. X-Ray diffraction by crystals – derivation of Bragg's equation — Bragg method-powder method crystal structure of NaCl, KCl, ZnS and CsCl – radius ratio and packing in crystals – determination of Avogadro's number.
- 4.1.4. Vitreous state – Brief studies.

UNIT –V**5.1. Liquid state:**

- 5.3.1. Liquid crystals – classification, structure, properties and applications.

5.2. Colloidal state.

- 5.2.1. Size of colloidal particles – Peptization, stability of colloids, coagulation and protection. Reverse Osmosis and desalination of sea water. Donnan – Membrane equilibrium. Electrophoresis and separation of proteins.
- 5.2.2. Gels and emulsions.

5.3. Macromolecules

- 5.3.1. Number average and weight average molecular weight of macromolecules – determination of molecular weight by osmometry (number average), ultra centrifuge (weight average), Viscometry and light scattering

References:

1. S.S.Dara – A text book of environmental chemistry and pollution control – S.Chand and Co.
2. D.N.Bajpai – Advanced physical chemistry – S.Chand and Co.
3. Bruce H.Mahan , “ University Chemistry ,” Narosa Publishers , NewDelhi.1989.
4. R.T Morrison and R.N.Boyd , “ Organic Chemistry ,” 6 th Edition

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 = 25 Answer All Questions (Either Or 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – IV (Major Theory)

Credits	: 5	Code: RR3CH3
Hors / Week	: 6	
Medium of Instruction	: Both Tamil and English	

SEMESTER – III

(For students admitted from 2015 onwards)

Inorganic, Organic and Physical chemistry – III

UNIT – I (Inorganic Chemistry)

1.1. Nitrogen family:

- 1.1.1. Comparative study of nitrogen family elements and their compounds (oxides, halides, hydrides and oxyacids)
- 1.1.2. Chemistry of hydrazine, hydrazoic acid, hydroxyl amine and sodium bismuthate.
- 1.1.3. Non aqueous solvents – classification – Liquid ammonia as solvent.

1.2. Zero group elements

Position in the periodic table - isolation of noble gases from the atmosphere and Uses - Compounds of xenon – XeF_2 , XeF_4 , XeF_6 , XeO_3 and XeOF_4 – Preparation, Properties, structure and uses.

1.3 Principles of Qualitative Analysis: Solubility product – principle of eliminating interfering radicals, common ion effect, complexation reactions including spot tests in qualitative analysis.

UNIT – II (Organic Chemistry)

2.1. Conformational Analysis.

- 2.1.1. Newmann projection, sawhorse formulae, Fischer projection, perspective formula, conformers of cyclohexane (boat, chair and skew-boat forms) – Axial and equatorial bonds – Ring Flipping – conformations of methylcyclohexane and dimethyl cyclohexanes.

2.2. Aromatic Hydrocarbons And Aromaticity.

- 2.2.1. Structure and stability of benzene ring – resonance in benzene – delocalized pi-electron cloud in benzene.
- 2.2.2. Aromaticity – Huckel's Rule ($4n + 2$) and examples – Cyclopropenyl cation – Benzene, Naphthalene, anthracene, furan, pyrrole, thiophene pyridine and Ferrocene.

UNIT – III (Organic Chemistry)

- 3.1. Electrophilic substitution reactions in aromatic compounds.

- 3.1.1. General mechanism of electrophilic substitution reactions – Effect of substituents – activating and deactivating groups – orientation.
- 3.1.2. Nitration, sulphonation, halogenation, Friedel – Craft’s alkylation and acylation reactions – Nuclear and side chain halogenation.
- 3.2. Polynuclear hydrocarbons
 - 3.2.1. Naphthalene and Anthracene – Isolation, properties, structure and uses.
 - 3.2.2. Aromatic nucleophilic substitution – Benzyne mechanism and intermediate complex formation mechanism – effect of substituents on reactivity.

UNIT – IV (Physical Chemistry)

4.1. Quantum Theory And Atomic Spectra

- 4.1.1 Bohr’s model of atoms. Bohr’s theory of hydrogen atom and spectral lines. Limitations of Bohr model. Sommerfield’s extension.
- 4.1.2 Photoelectric effect and Compton Effect. De Broglie’s equation and verification. (Davisson and Germer experiment).
- 4.1.3 Heisenberg’s uncertainty principle – Schrodinger wave equation – Eigen values and eigen functions – Significance of ψ and ψ^2 - Radial and angular distribution function – Concept of orbitals and shapes of orbitals.

4.2. Chemical Bonding And Molecular Structure.

- 4.2.1. V.B.Theory – postulates – application to the formation of simple molecules like hydrogen and helium. Overlap of atomic orbitals and principles of hybridization.
- 4.2.2. M.O.Theory – bonding and antibonding molecular orbitals – MO diagrams of simple homonuclear diatomic molecules. (H_2 , H_2^+ , He_2 , He_2^+ , Li_2 , Be_2 , B_2 , N_2 , O_2 & F_2) and hetero nuclear diatomic molecules – HF and CO.
- 4.2.3. Comparison of V.B. and M.O. Theories

UNIT –V (Physical Chemistry)

5.1. Electric Properties of Matter.

- 5.1.1. Electric properties of molecules – polarization, polarizability and dipole moment. Atomic, induced and orientation polarization – Mosotti – Clausius equation – measurement of molar polarization.
- 5.1.2. Dipole moment – determination by Temperature, Refractivity and Dilute solution methods. Dipole moment of diatomic and polyatomic molecules – Bond moments.

Applications of dipole moment measurements:

 - a. in determining the percent ionic character of bonds.
 - b. shapes of simple inorganic and organic molecules (BCl_3 , H_2O , CO_2 , NH_3 , CCl_4).
 - c. dipole moment of substituted benzenes – o, m & p-dichlorobenzene.

5.2. Magnetic Properties of Matter.

- 52.1. Magnetic flux – magnetic permeability – magnetic susceptibility. Diamagnetism, paramagnetism, ferro and anti –ferro magnetism – Curie temperature.
- 52.2. Determination of magnetic susceptibility – Guoy’s method – Number of unpaired electrons – spin only magnetic moment value. Application to structural problems. $K_3Fe(CN)_6$, $K_4Fe(CN)_6$, $Ni(CO)_4$.

References:

1. P.L.Soni & Mohankatyal, Text Book of Inorganic Chemistry 20th revised edition, Sultan Chand 1992.
2. R.B.Puri & L.R.Sharma, "Principles of Inorganic Chemistry", Sultan Chand, 1989.
3. P.L.Soni & H.M.Chawla "Text book of Organic Chemistry" Sultan Chand & Sons 1994, Delhi.
4. K.S.Tewari, S.N.Mehrotra and N.K.Vishnoi, "A Text Book of Organic Chemistry".
5. M.K.Jain, "Organic Chemistry" Shoban Lal Nagin Chand and Co.,
6. B.R..Puri, L.R.Sharma and Madan S.Pathania, "Principles of Physical Chemistry" Shoban Lal Nagin Chand and Co., Delhi.
7. Vogel's "Text Book of Quantitative Chemical Analysis" E.L.B.S.
8. R.D.Madan, "Modern Inorganic Chemistry", 1987, S.Chand and Company (Private) Ltd.,
9. P.L.Soni, "Text book of Organic Chemistry, Sultan Chand & Co., New Delhi.
10. D.A Mc Quarrie, " Quantum Chemistry," University Science Books

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 = 25 Answer 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

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

Core Course – IV (Major Practical)

Credits	: 5	Code: RR4CHP2
Hors / Week	: 6	
Medium of Instruction	: Both Tamil and English	

SEMESTER – III & IV

(For students admitted from 2015 onwards)

PRACTICAL – I : INORGANIC QUALITATIVE ANALYSIS

(Examination at the End of Semester - II)

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion.

Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations To Be Studied:

Lead, Copper, Bismuth, Cadmium, Antimony, Iron, Aluminum, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

Anions To Be Studied:

Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate

Note :

Record	: 5 Marks
Practical	: 55 Marks
CIA	: 40 Marks
Total	: 100 Marks

All the Four Radicals with systematic Procedure	: 55 Marks
Only Three Radicals with systematic Procedure	: 40 Marks
Only Two Radicals with systematic Procedure	: 25 Marks
Only One Radical with systematic Procedure	: 15 Marks
If all the four Radicals are incorrect	: 00 Marks

Mere Reporting a Radical with wrong/without Procedure : 02 Marks

For the Record a minimum of 3 Marks may be given

If the student appears for the first time for that particular Practical Examination he should be permitted only if he submits the duly signed Bona fide Record Note Book; otherwise the examiners should not permit him for that practical examination.

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – V (Major Theory)

Credits : 5 **Code: RR4CH4**
 Hors / Week : 6
 Medium of Instruction : Both Tamil and English

SEMESTER – IV

(For students admitted from 2015 onwards)

Inorganic, Organic and Physical chemistry – IV

UNIT – I (Inorganic Chemistry)

1.1. Alkali And Alkaline Earth Metals

- 1.1.1. Comparative study of alkali metal and alkaline earth metal compounds (oxide, halides, hydroxides, carbonates, sulphates).
- 1.1.2. Diagonal relationship between lithium and magnesium.
- 1.1.3. Preparation, properties and uses of lithium aluminium hydride and sodium borohydride

1.2. Coinage Metals.

- 1.2.1. Comparative study of coinage metals and Chemistry of photography.

1.3. Transition Metals And Their Compounds

- 1.3.1. Group study of titanium, vanadium, chromium, manganese.
- 1.3.2. Metallurgy and uses of V, W and Mo.
- 1.3.3. Steel and alloy steels. Heat treatment of steel.

UNIT –II (Inorganic Chemistry)

1.3.2.1.1. Inner Transition Elements:

- 1.3.2.1.1.1. Lanthanides – occurrence – general study of lanthanides involving electronic configuration, oxidation states, magnetic properties and complexation behaviour.
- 2.1.2. Lanthanides – separation by ion exchange and solvent extraction methods – lanthanide contraction.
- 2.1.3. Actinides – Occurrence – electronic configuration, oxidation states, magnetic properties and complexation behaviour.
- 2.1.4. Comparison of lanthanides and actinides and their position in the periodic table.
- 2.1.5. Elements with atomic number 104 and 105; preparation and their position in the periodic table.
- 2.1.6. Chemistry of thorium and uranium – occurrence, ores, extraction and uses.

UNIT – III (Organic Chemistry)

3.1. Grignard reagents and their synthetic uses.

3.2. Aliphatic nucleophilic substitutions – mechanism of SN^1 , SN^2 and SNi reactions, effect of solvents, leaving groups, nucleophiles and structure of substrates.

3.3. Elimination reactions – Hofmann and Saytzeff's eliminations – cis-trans eliminations. Mechanism of E_1 and E_2 reactions.

3.4 Relative reactivity of ethyl, vinyl, allyl and benzyl halides.

3.5 Ethers

3.6 Methods of preparation of aliphatic and aromatic ethers – reactions of ethers – 1,4-dioxin –Preparation and uses – Epoxides – Preparation and reactions. Acid-base mechanism of cleavage of epoxides

3.7 Thioethers – Preparation and uses

UNIT – IV (Physical Chemistry)**3.7.1 Chemical Kinetics**

- 3.7.1.1 Rates of reactions, rate laws, rate constant, order and molecularity of reactions. Rate equations for zero, first, second and third order reactions. Fractional order reactions. Examples: Half life period, Pseudo first order reactions examples.
- 3.7.1.2 Methods of determining the order of reactions. Integration, graphical, half-life and Oswald's isolation methods. Experimental.
- 3.7.1.3 Temperature dependence of reaction rates – Arrhenius parameters and calculations.
- 3.7.1.4 Theories of reaction rates – simple collision theory – limitations – steady state approximation – Lindeman's hypothesis of unimolecular reactions – Theory of absolute reaction rates. (elementary treatment only)

UNIT – V (Physical Chemistry)**5.1. Catalysis and Adsorption.**

- 5.1.1. Homogeneous and heterogeneous catalysis – Gibb's adsorption isotherm – statement only – Langmuir adsorption isotherm – statement and application to surface area calculations. Intermediate complex and adsorption theories. Types of catalysis promoters and poisons (Inhibitors).
- 5.1.2. Enzyme catalysis – mechanism – factors affecting enzyme catalysis - Michaelis – Menton equation.

5.2. Photochemistry.

- 5.2.1. Grothus – Draper Law, Lambert – Beer's Law, Stark-Einstein's Law of photochemical equivalence – Quantum yield – Examples of low and high quantum yield (Decomposition of HI, Formation of HCl and HBr – Actinometry. Comparison of thermal and photochemical reactions of HBr.
- 5.2.2. Photochemical chain reactions – primary and secondary processes. $H_2/C1_2$ reaction – photolysis of aldehydes and ketones. Photosensitization – photosynthesis – Photodimerisation of anthracene.
- 5.2.3. Luminescence, fluorescence, phosphorescence, Chemiluminescence and bioluminescence.

References:

1. R.Gopalan, P.S.Subramanian, K.Rengarajan – “Elements of Analytical Chemistry” Sultan Chand & Sons.
2. V.S.Parmar & H.M.Chawla – “Principles of reaction mechanisms in Organic Chemistry”.
3. P.L.Soni & Mohan Katyal, “Text Book of Inorganic Chemistry”.
4. I.L.Finar, “Organic Chemistry, Volume I” E.L.B.S. LONDON.
5. B.R.Puri, L.R.Sharma and Madan, S.Pathma, “Principles of Physical Chemistry”.
6. R.D.Madan, “Modern Inorganic Chemistry”, 1987, S.Chand and Company (Private Limited), New Delhi.

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 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – VII (Major Theory)

Credits	: 5	Code: RR5CH5
Hors / Week	: 6	
Medium of Instruction	: Both Tamil and English	

SEMESTER – V

(For students admitted from 2015 onwards)

Inorganic Chemistry – I

UNIT – I Coordination Compounds

- 1.1. Types of ligands. IUPAC nomenclature
- 1.2. Theories of coordination compounds – Werner, Sidgwick, Valence bond, Crystal field, molecular orbital and ligand field theories.

UNIT – II Isomerism

- 2.1. Isomerism – stability of complexes – factors affecting the stability of complexes
- 2.2. Unimolecular and bimolecular nucleophilic substitution reactions in octahedral and square Planar complexes – Trans effect.
- 2.3. Application of coordination compounds – Detection of potassium ions, separation of copper and cadmium ions. Estimation of nickel using DMG and aluminium using oxine.
- 2.4. Structure of EDTA and its complexes. Complexometric titrations – principles and applications.

UNIT – III biologically and Metal carbonyls

- 3.1. Biologically important coordination compounds – Chlorophyll, haemoglobin, vitamin B12 – their structure, application (Elucidation is not required)
- 3.2. Metal carbonyls – Mono and poly nuclear carbonyls of Ni, Fe, Cr, Co and Mn – synthesis, reactions, structure and uses.
- 3.3. Nitrosyl compounds – classification, preparation, properties and structure of nitrosyl chloride and sodium nitroprusside.

UNIT – IV Binary and Organometallic compounds

- 4.1. Binary compounds – hydrides, borides, carbides and nitrides classification - preparation, properties and uses.
- 4.2. Organometallic compounds of alkenes, alkynes and cyclopentadiene

UNIT – V Fossil fuels

- 5.1. Fossil fuels – varieties of coal and petroleum- Petroleum refineries in India.

- 5.2. Fertilisers- Manufacture of N,P,K and mixed fertilisers. Micronutrients and their role in plant life.
- 5.3. Safety matches fire works and explosive, paints and varnishes.
- 5.4. Effluents and their treatment (Dye, cement, tannery, distillery units)- Factory visit recommended.

References:

1. P.L.Soni,: Text Book of Inorganic Chemistry, S.Chand & Co., New Delhi (1999)
2. B.R.Poori, & L.R.Sharma : Principles of Inorganic Chemistry, Shoban Lal, Nagin Chand & Co., New Delhi (2000)
3. R.D.Madan, G.D.Tuli and S.M.Malik, Selected Topic in Inorganic Chemistry, S.Chand & Co., New Delhi (1988)
4. J.D.Lee : Concise Inorganic Chemistry, E.L.B.S., IV Edn,m (1991)
5. Jeffery et al : “Vogel Text Book of Inorganic Quantitative Analysis”, Longman (1984)
6. D.A.Skoog and D.M.West : “Fundamentals of Analytical Chemistry W.B.Saunders, New York (1983)
7. P.K.Bhattacharya : Chemical Applications of Group Theory, Himalaya Publishing House, Mumbai. (1998)
8. F.A.Cotton, Chemical Application of Group Theory,” Third Edition, JohnWiley and Son , New York, 2002
9. M.S.Gopinath and V.Ramkrishnan : Group Theory and Applications (1988)
10. D.F.Shriver and P.W .Atkins, “ Inorganic chemistry “ III rd Edition, Oxford University Press, 1999
11. M.C.Day and Selbin , “Theoretical Inorganic Chemistry “ ,Second Edition : Affiliated East- West Press New Delhi, 1969

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 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16)
Core Course – VIII (Major Theory)

Credits	: 4	Code: RR5CH6
Hours / Week	: 5	
Medium of Instruction	: Both Tamil and English	

SEMESTER – V
(For students admitted from 2015 onwards)

Organic Chemistry – I

UNIT – I

Stereoisomerism - I

- 1.1. Stereoisomerism – Definition – Classification into optical and Geometrical isomerisms.
- 1.2. Optical isomerism – Optical activity – Optical and specific rotation conditions for optical activity in solid, liquid and gaseous phases – criteria for optical activity. Asymmetric centre Chirality – Achiral molecule – Meaning of + and – and D and L notations – Elements of symmetry – Racemization – Methods of Racemization (by substitution and tautomerism) Resolution – Methods of Resolution (Mechanical separation, seeding, biochemical and conversion to diastereoisomers) – Asymmetric synthesis partial and Absolute asymmetric synthesis) – Walden inversion, Vant Hoff rule of superposition – Freudenberg's rule of shift.
- 1.3. Notations for optical isomers – Cahn – Ingold – Prelog rules – R/S notations for optical isomer with one asymmetric carbon – Erythro and Threo representations . Fischer projection, Sawhorse, Newmann projection representation of molecules with two asymmetric carbon atoms.

UNIT – II

Stereoisomerism – II

- 2.1. Optical activity in compounds containing no asymmetric carbons – Biphenyls, Allenes and Spiranes. Optical activity on symmetric & asymmetric system (Lactic acid) dissymmetric system (1,2 trans cyclopropanedicarboxylic acid) symmetric – system – (Meso tartaric acid)
- 2.2. Geometrical isomerism – cis-trans, Syn – Anti and E-Z notations – Geometrical isomerisms in Maleic and Fumaric acids and in unsymmetrical ketoximes – Methods of distinguishing geometrical isomers (Dipole moment, Dehydration, Heat of Hydrogenation, cyclization, Melting points) – Methods of determining the configuration of geometrical isomers (No details required). Geometrical and optical isomerism in three membered rings.

UNIT – III

Reactions of Carbonyl Compounds

- 3.1. Carbonyl Polarization – Reactivity of carbonyl group – Acidity of alpha Hydrogen.
- 3.2. Mechanisms of Aldol, Perkin, Knoevenagel and Benzoin condensation Mechanisms of Claisen, Reformatsky, Wittig and Cannizzaro reactions.
- 3.3. Mechanisms of Reduction (Sodium borohydride, LiAlH₄ Wolff – Kishner and MPV reductions) – Mechanisms of Haloform reaction and Michael addition and Oppenauer Oxidation.
- 3.4. Photochemistry of carbonyl compounds – Norrish I and II Types. Problems and Conversion wherever applicable.

UNIT – IV**Acids And Acid Derivatives**

- 4.1. Ionization of carboxylic acids – Acidity constant – comparison of acid strengths of substituted halo acids – Acid strength of substituted Benzoic acids – Hammett equation. Hell-volhard- Zelinski reaction
- 4.2. Dicarboxylic acids – Preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids, unsaturated acids and hydroxy acids
- 4.3. Malonic and Acetoacetic esters – Characteristics of reactive methylene group – Synthetic uses of Malonic and acetoacetic esters.
- 5.2. Tautomerism – Definition – Keto Enol Tautomerism (identification, Acid and base catalysed Interconversion Mechanism, Preparations, Amido – imido and Nitro – Acinitro tautomerisms (Just inter – conversions shown).
- 4.5. Nucleophilic acyl substitutions, acid –base catalysed hydrolysis of ester, hydrolysis of amides and transesterification.

UNIT - V**Heterocyclic Compounds**

- 5.1. Aromatic characteristics of heterocyclic compounds.
- 6.2. Preparation, Properties and uses of Furan, Pyrrole Thiophene.
- 5.3. Synthesis and reactions of pyridine and piperidine-comparative basic characters of pyrrole, pyridine and piperidine with amines.
- 5.4. Synthesis and reactions of Quinoline, Isoquinoline and Indole with special reference to Skraup, Bischler Napieralski and Fischer indole synthesis. Structural elucidation of Pyridine, Quinoline and iso quinoline.

References :

1. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry : S.Chand & Co, New Delhi.(1988)
2. P.L.Soni and H.M.Chawla : Text book of Organic Chemistry – 28th Edition (1999) – Sultan Chand. New Delhi.
3. Ravi Bhushan : Stereoisomerism of carbon compounds – CBS – Publishers, Delhi – Revised edn.(1998)
4. P.S.Kalsi : Stereochemistry, conformation and mechanism, Willey Eastern Limited, New Delhi.
5. O.P.Agarwal : Chemistry of Natural Products, Volume 1 & 2.
6. D.Nasipuri, Stereochemistry of Organic Compounds, Wiley Eastern Ltd., New Delhi (1992)
7. I.L.Finar, Organic Chemistry Volume 1, E.L.B.S., London, (1998) Seyhan Ege , “Organic Chemistry – Structure and reactivity” –AITBS Publishers
8. R.K.Bansal , “ Organic Reaction Mechanisms,” Tata Mc Graw Hill, 1975
9. P.S.Kalsi,” Organic Reactions and their Mechanism,” New Age International Publishers
10. S.H Pine , J.B.Hendrickson,D.J. Cram and G.S Hammond, “ Organic Chemistry,” Mc Graw Hill fourth Edition, 1980.

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 = 25 Answer All Questions (Either Or 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16)
Core Course – IX (Major Practical)

Credits : 4

Code: RR5CHP3

Hors / Week : 3

Medium of Instruction : Both Tamil and English

SEMESTER – V

(For students admitted from 2015 onwards)

Organic Chemistry Practical – III**I. Organic Chemistry Practical's (100 Marks)**

Record Note Book	: 5 marks
Practical Examination	: 55 marks
CIA	: 40 marks
Total	: 100 marks

- Preparation involving
 - oxidation,
 - reduction
 - hydrolysis
 - nitration
 - sulphonation
 - halogenations
 - diazotization.
- Characterization of organic compounds by their functional groups and confirmation by preparation of derivatives

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – MEC1 (Major Elective)

Credits	: 4	Code: RR5CHEL1
Hors / Week	: 5	
Medium of Instruction	: Both Tamil and English	

SEMESTER – V

(For students admitted from 2011 onwards)

Physical Chemistry – I

UNIT – I

Chemical thermodynamics (18 Hours)

- 1.1. Definition of thermodynamic terms : Systems and surrounding – isolated, closed, and open systems – Homogeneous & Heterogeneous systems, State of the system intensive and extensive variables. Thermodynamic process – cyclic processes, reversible and irreversible, isothermal and adiabatic processes – State and Path functions, exact and inexact differentials, concept of heat and work. Work of expansion at constant pressure and free expansion.
- 1.2. Laws of Thermodynamics: The zeroth law and the first law of thermodynamics :
 - 1.2.1. First law of thermodynamics – statements, Definition of internal energy (U), enthalpy (H) and Heat capacity. U and H as thermodynamic properties. Relation between C_p and C_v ; calculation of W, Q, ΔU and ΔH for expansion of ideal and real gases under isothermal and adiabatic conditions for reversible and irreversible processes.
 - 1.2.2. Joule – Thomson effect, Joule – Thomson experiment. Relationship between μ_{JT} and other thermodynamic quantities. Calculation of μ_{JT} for ideal and real gases. Joule Thomson coefficient and inversion temperature. The Zeroth law of thermodynamic and absolute scale of temperature.
- 1.3. Thermochemistry :
 - 1.3.1. Internal energy and enthalpy changes in chemical reactions. Relation between ΔU and ΔH Relation between enthalpy of reaction at constant volume (Q_v) and at constant pressure (Q_p). Thermochemical equations, laws of thermochemistry – Hess's law and its applications.
 - 1.3.2. Standard states – Standard enthalpy of formation. Enthalpy of combustion, enthalpy of Neutralization, integral and differential heats of solution and dilution. Bond dissociation energy - its calculation from thermochemical data. Temperature dependence of $-\Delta H$ Kirchoff's equation.

UNIT – II

Second Law of Thermodynamics. (18 Hours)

- 2.1. Second Law of Thermodynamics : Need for the law. Different statements of the law. Heat engine – Carnot's cycle and its efficiency. Refrigeration cycle – Carnot's theorem – Thermodynamic scale of temperature.
- 2.2. Concept of Entropy: Entropy as a state function – Entropy as a function of P, V and T. Entropy changes in phase changes. Entropy of mixing – Clausius inequality – entropy as a criterion of spontaneous and equilibrium processes in isolated systems.
- 2.3. Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities - UA and UG as criteria for thermodynamic equilibrium and spontaneity – their advantage over entropy change. Variation of UA and UG with P, V and

T Gibbs – Helmholtz equations and their applications. Thermodynamic equation of state. Maxwell's relations.

UNIT – III

Applications of Second Law of Thermodynamics & Third Law of Thermodynamics

- 3.1. Equilibrium constants and free energy change. Thermodynamic derivation of Law of Mass Action. Equilibrium constants in terms of pressure and concentration – NH_3 , PCl_5 , CaCO_3 . Thermodynamic interpretation of Le Chatelier's principle. (Concentration, temperature, pressure and addition of inert gases.)
- 3.2. Equilibrium between different phases – System of variable composition – Partial molar quantities – Chemical Potential of component in an ideal mixture – Gibbs Duhem equation – Variation of chemical potential with T, P, and X (mole fraction).
- 3.3. Reaction isotherm – van't Hoff's equation – van't Hoff's isochore. Clapeyron equation and Clausius Clapeyron equation – Applications.
- 3.4. Third Law of Thermodynamics: Need for the law. Nernst heat theorem. III law of thermodynamics – statement and concept of residual entropy. Evaluation of absolute entropy from heat capacity data. Exception to third law. (Ortho & Para Hydrogen, CO, N_2O and Ice).

UNIT – IV

Phase Rule

- 4.1. Meaning of the terms – Phase, Component and Degree of Freedom. Derivation of Gibb's phase rule. Phase equilibria of one component systems – water, CO_2 and sulphur systems.
- 4.2. Phase equilibria of two component systems – Solid – Liquid equilibria – Simple Eutectic systems – Bi- Cd and Pb-Ag systems – Desilverisation of lead.
- 4.3. Compound formation with congruent melting points (Mg-Zn) and incongruent melting points (Na-K). NaCl – water and FeCl_3 – water systems – Freezing mixtures. Gas – Solid Equilibria – (CuSO_4 – water system). Efflorescence and Deliquescence.
- 4.4. Symmetry elements – symmetry operations – mathematical group multiplication tables, point group of simple molecules (H_2 , HCl , CO_2 , H_2O , BF_3 and NH_3)

UNIT – V

Solutions

- 5.1. Ideal binary liquid mixtures: Ideal liquid mixtures – (Benzene and Toluence)- Raolt's law and Henry's law – Deviation from Raolt's law and Henry's law. Activity and activity coefficient. Duhem – Margule's equation –its application to fractional distillation of binary miscible liquids – Non ideal systems – Azeotropes – (HCl – water & Ethanol – water systems). Applications of Azeotropes in organic chemistry.
- 5.2. Partially miscible liquid pairs – Phenol – Water, Triethanol amine – Water and Nicotine – Water systems – Lower and Upper CSTs. Effect of impurities on CST.
- 5.3. Immiscible liquids – Principle and applications of steam distillation. Nernst Distribution Law - Derivation and applications.
- 5.4. Dilute solutions and colligative properties: Determination of molecular weights – Relative lowering of vapour pressure. Laws of Osmosis – Osmotic pressure and its applications. Elevation of Boiling point and Depression of Freezing point – Thermodynamic derivation.

Determination by experimental methods. Relation between colligative properties and molecular mass. Abnormal molecular mass. Vant Hoff factor, Degree of dissociation and association of solutes.

References:

1. Principles of Physical Chemistry, B.R.Pru & Sharma.
2. Text book of Physical Chemistry, P.L.Soni.
3. Advanced Physical Chemistry , Gurdeep Raj
4. Essentials of Physical Chemistry, B.S.Bahl., G.D.Tuli & Arun Bahl, S.Chand & Co., New Delhi. (1999)
5. Thermodynamics for Chemists, Samuel Glasstone.
6. Simplified course in Physical Chemistry, R.L.Madan, G.D.Tuli.S.Chand & Co., N.Delhi (1999)
7. Thermodynamics for students of Chemistry, Rajaram and Kuriacose.
8. P.W.Atkins, Physical Chemistry, ELBS , Oxford Univ. Press , 1998.
9. R.A .Alberty and R.J.Silbay,Physical Chemistry, John Wiley and sons.Inc., New York, 1995.
10. Gordon . M Barrow, Physical Chemistry” , Tata Mc Graw Hill , New Delhi
11. I.N.Lerine, Physical Chemistry, Tata Mc Graw Hill, New Delhi, 2002.

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 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – MEC2 (Major Elective)

Credits	: 4	Code: RR5CHEL2
Hors / Week	: 5	
Medium of Instruction	: Both Tamil and English	

SEMESTER – V
(For students admitted from 2015 onwards)

Analytical Chemistry

UNIT –I

1.1 Laboratory Hygiene And Safety

Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals.

1.2 Simple First Aid Procedure For Accidents

Acid in eye, alkali in eye, acid burns, bromine burns, poisoning, inhalation of gases, cut by glasses and heat burns.

1.3 Errors in chemical analysis, classification of errors, instrumental errors, personal errors, constant errors and proportional errors – Correction of determinate errors -Random errors. Precision, accuracy and rejection of data questioned. Significant - Figures. Mean deviation and standard deviation. Curve fitting, Method of least squares.

UNIT- II

2.1 Separation And Purification Techniques

General principles involved in the separation of precipitates. Solvent extraction.

2.2 Chromatography

Principles in adsorption, partition and ion exchange, paper, thin layer, column, gas liquid chromatography. Electro-phoresis- Applications.

2.3 Desiccants Vacuum drying, distillation, fractional distillation, steam distillation, Azeotropic Distillation, crystallization and sublimation – Principles and Techniques.

UNIT – III

3.1 Thermo analytical Methods

Principles involved in thermogravimetric analysis and differential thermal analysis-instrumentation.

Characteristics of TGA (CaC_2O_4 , H_2O , $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) and DTA curves ($\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$). Factors affecting TGA and DTA curves.

3.2 Thermometric titration of HCL Vs NaOH.

3.3 Analytical Electrochemistry

Redox potential – measurement and application, interpretation of chemical behaviour. Electrolytic separations. Principles of electrode deposition. Electro-gravimetry (estimation of copper and silver.)

3.4. Basic concepts of paleography technique.

UNIT – IV

4.1 Colorimetric Analysis

- Laws of colorimetry – instrumentation. Nessler’s and photo electric colorimetric method – operation and applications. Estimation of Ni, Cu and Fe.
- 4.2 Basic principles of flame photometry – Atomic absorption – Spectrophotometry – Estimation of Na, K and Ca.
- 4.3 **Organic Estimations**
Principle and methods to estimate glucose, ascorbic acid, phenol, aniline, ketone, oils and fats. Iodine value, saponification value, R.M value and acetyl value.

UNIT – V

- 5.1 Elementary features of C programming.
- 5.2 Structure, data types, variables, constants, keywords operators, expressions and Library Functions
- 5.3 Control structures in C –if, if – else, go to, while, do...while loop.
- 5.4 Examples of simple chemistry programs.
- Conversion of Celsius temperature to Kelvin temperature. Conversion of Celsius to Fahrenheit and vice versa.
 - Application of Beer Lambert Law.
 - ΔE for atomic spectral transition using Rydberg equations.
 - Rate constant for a first order reaction.
 - pH of a buffer solution using Henderson equations.

Reference:

- R.Gopalan, P.S.Subramanian and K. Rengarajan: “Elements of Analytical Chemistry, “Sultan Chand & sons, New Delhi. (1995)
- B.K.Sharma ; Instrumental Methods of chemical analysis, Goel Publishing House, Meerut (1999).
- S.M.Khopkar ; Basic Concepts of Analytical Chemistry New Age International (P)Ltd, New Delhi (1998)
- Gurdeep Chatwal, Sham Anand; Instrumental methods of Chemical Analysis, Himalaya Publishing House, Mumbai (1998).
- R.A Day and A.L Underwood. “ Quantitative analysis “ Prentice Hall of India, New Delhi
- D.A.Skoog & D.M.West; Fundamentals of Analytical Chemistry W.B.Saunders, New York,(1982).
- K.V.Raman; Computers in chemistry Tata Mc Graw Hill Co., New Delhi(1993).
- B.G.Gottfried; BASIC Programming Mc Graw Hill International Ltd.,(1987).
- B.G.Gottfried; C Language Programming Mc Graw Hill International Ltd.,(1987).
- E.Balagurusamy; C Programming Tata Mc Graw Hill Co., New Delhi(1997).
- H.Schildt; C and C++ Programming, Mc Graw Hill International Ltd.,(1998).
- K.V.Raman Chemistry Education, New Delhi july (1992).
- K.B.Baliga, S.M.Shetty : College Analytical Chemistry, Himalaya Publishing House (1998).
- A.I.Vogel : Text Book of Quantitative Inorganic Analysis, Longman(1984).
- G.W.Ewing : Instrumental Methods of Chemical Analysis, Mc Graw Hill(1988).

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 = 25 Answer All Questions (Either 0r type -Two questions from each unit)

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Signature of the HOD

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

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

Core Course –X (Major Theory)

Credits : 5 **Code: RR6CH7**

Hors / Week : 5

Medium of Instruction : Both Tamil and English

SEMESTER – VI

(For students admitted from 2015 onwards)

Inorganic Chemistry - II

UNIT – I Nuclear chemistry

- 1.1 Introduction – composition of nucleus and nuclear forces.
- 1.2 Nuclear stability – n / p ratio, mass defect, binding energy, packing fraction and magic numbers, shell and liquid drop models.
- 1.3 Isotopes – detection and separation. Isotopic constitution of elements and whole number rule. Deviation of atomic weights from whole numbers. Isobars, isotones and isomers.

UNIT – II Radioactivity And Nuclear Transformations

- 2.1 Radioactivity – discovery, detection and measurements (Wilson cloud chamber). Radioactive emanations. Disintegration theory – modes of decay – Group displacement law – Rate of disintegration – Half life and average life – Radioactive series.
- 2.2 Nuclear transformations – use of projectiles – nuclear reactions – fission and fusion. Nuclear reactors. Applications of radio isotopes – Carbon dating – Radio active waste disposal.
- 2.3 Radiolysis of water and hydrated electron.

UNIT – III Metallic State

- 3.1 Packing of atoms in metal (BCC, FCC (CCP), HCP)
- 3.2 Theories of metallic bonding – electron gas, Pauling and band theories.
- 3.3 Structure of alloys – substitutional and interstitial solid solutions – Hume Rothery ratios – crystal defects.
- 3.4 Semi conductors – Extrinsic and intrinsic – n-type and p-type- composition, structure and uses in electronic industry.

UNIT – IV Some Special Classes Of Compounds.

- 4.1 Clathrates- examples and structures. Interstitial compounds and non-stoichiometric compounds.
- 4.2 Silicones – composition, raw materials, manufacture, structures, properties and uses.
- 4.3 Metal alkyls, co-ordination polymers and phosphonitrilic polymers.

- 4.4 Silicates – Classification into discrete anions, one. Two and three dimensional structures with typical examples composition, properties and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

UNIT – V Gravimetric Analysis:

- 5.1. Characteristics of precipitating agent – choice of precipitants – specific and selective precipitant. Condition of precipitation. Types of precipitates. Purity of precipitates. Co-precipitation and post precipitation. Precipitation from homogeneous solution. Digestion and washing of precipitate. Ignition of the precipitate. Use of sequestering agents.

References:

1. P.L.Soni, Mohan Katyal, 'Text Book of Inorganic Chemistry', 20th revised edn., Sultan Chand, 1992.
2. Esmarch S.Gilreath, 'Fundamental concepts of Inorganic Chemistry', International students edn., Mcgraw-Hill Kogakusha, Ltd., 1958.
3. Gurdeep Chatwal and M.S.Yadu, 'Co-ordination Chemistry', First edn., Himalaya Publishing House, 1992.
4. B.R.Puri and L.R.Sharma, 'Principles of Inorganic Chemistry', Shoban Lal Nagin Chand and Co., 1989.
5. Cotton and Wilkinson, 'Advanced Inorganic Chemistry', 5th edn.,
6. R.D.Madan, 'Modern Inorganic Chemistry'.
7. S.Glasstone, 'Source Book on Atomic Energy', 3rd edn., Affiliated East West Press, 1967

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 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16)
Core Course – XI (Major Theory)

Credits	: 4	Code: RR6CH8
Hors / Week	: 5	
Medium of Instruction	: Both Tamil and English	

SEMESTER – VI

(For students admitted from 2015 onwards)

Physical Chemistry – II

UNIT – I Electrical conductance:

- 1.1. Measurement of equivalent conductance using Kohlrausch's bridge. Variation of equivalent conductance with concentration.
- 1.2. Migration of ions-Kohlrausch's law and its applications. The elementary treatment of the Debye-Huckel Onsager equation for strong electrolytes. Evidence for ionic atmosphere. The conductance at high fields (Wien effect) and high frequencies (Debye-Falkenhagen effect). Transport number and Hittorf's rule-determination by Hittorf's method and moving boundary method.
- 1.3. Application of Conductance Measurements. Determination of λ of a strong electrolyte and acids. Determination of K_a of acids. Determination of solubility product of a sparingly soluble salt. Common ion effect. Conductometric titrations.

UNIT – II Acids and Bases:

- 2.1. Modern theories of acids and bases – Bronsted-Lowry concept and Lewis concept, factors that influence the strength of acids and bases. Definition of pH and pKa.
- 2.2. Buffers-mechanism of buffer action- Henderson-Hasselbalch equations. Determination of pH by colorimetric method.
- 2.3. Hydrolysis of Salts: Neutralisation, Hydrolysis constant, Relations between K_h, K_a, K_w and K_b . Degree of hydrolysis. pH of hydrolysed salt solutions. Calculation of hydrogen ion concentration-salts of strong and weak acids with weak bases.

UNIT – III Equilibrium In Electrochemical Cells:

- 3.1. Electrolytic and galvanic cells. Reversible and irreversible cells. Conventional representation of Electrochemical cells. Electromotive force of a cell and its measurements. Computation of cell e.m.f. calculation of thermodynamic quantities of cell reactions (ΔG , ΔH , ΔS and K). Applications of Gibbs Helmholtz equation, concentration and E.M.F. Nernst equation.
- 3.2. Types of reversible electrodes – Gas/metal ion, metal/metal ion, metal/insoluble salt/anion and Redox electrodes. Electrode reactions. Nernst equation- derivation of cell EM.F. and single electrode potentials. Standard hydrogen electrode – reference electrodes- standard electrode potentials – sign conventions – Electrochemical series and its significance.

- 3.3. Concentration cell with and without transport. Liquid junction potential. Application of concentration cells- Valency of ions, solubility product and activity co-efficient, potentiometric titrations. Determination of pH using hydrogen, quinhydrone and glass electrodes. Determination of P_{ka} of acids by potentiometric methods.
- 3.4. Corrosion – general theory – Electrochemical theory- passivity – prevention of corrosion.

UNIT – IV – Spectroscopy - I

- 4.1. Definition of spectrum. Electromagnetic radiation, interaction of electromagnetic radiation with molecules and quantization of different forms of energies in molecules. (translational, rotational, vibrational and electronic).
- 4.2. Microwave spectroscopy- condition-molecular rotation-theory of microwave spectroscopy- Selection rule. Effect of isotopic substitution and calculation of moment of inertia and bond length of diatomic molecules.
- 4.3. Infra red spectroscopy – condition-molecular vibration- modes of vibration of linear and non-linear molecules, modes of vibration of diatomic, triatomic linear (CO_2) & non-linear triatomic (H_2O) molecules-Stretching & bending vibrations – selection rules, expression for vibrational frequency (derivation not needed). Calculation of force constant – isotope effect – Applications of I.R.spectra (group frequencies, finger printing and Hydrogen bonding only).
- 4.4. Raman spectroscopy – condition – Raleigh and Raman scattering – stokes and ant stokes lines- Difference between Raman and I.R. Spectroscopy – Rotational Raman spectra of non-centro symmetric molecule (HCl only). Application to covalent compounds. Mutual exclusion principle.
- 4.5. U.V.-Visible spectroscopy – condition – theory of electronic spectroscopy – types of electronic transitions – Frank – Condon principle – predissociation – Applications.

UNIT – V - Spectroscopy - II

- 5.1. N.M.R.Spectroscopy – magnetic and non-magnetic nuclei – condition – principle of nuclear magnetic resonance – ring current effect – shielding mechanism – chemical shift – Number of signals – spin – spin. Coupling – coupling constant (J) – splitting of signals –NMR spectra of simple organic compounds. NMR spectrum of ethylalcohol in detail.
- 5.2. E.S.R. Spectroscopy – condition – theory of ESR spectra – Hyperfine splitting – ESR spectra of Simple radicals CH_3 methyl, CD_3 , naphthalene, negative ion only).
- 5.3. Mass spectroscopy – Basic principles of mass spectroscopy, molecular ion peak, base peak, Isotopic peak and metastable peak – Nitrogen rule and ring rule. Mass spectrum of simple organic compounds. (Acetaldehyde. Ethylalcohol, CH_3NH_2 & Toluene)

Reference:

1. B.R.Puri & L.R.Sharma. Principles of physical chemistry.
2. R.P.Varma & Pradeep. Physical chemistry.
3. C.N.Banwell, Fundamental molecular spectroscopy. Tata McGraw Hill publications, New Delhi 11th reprint 1991.
4. William kemp, Organic spectroscopy, ELBS, Second edition 1987.
5. Dr.S.Jain & S.P.Jankar, physical chemistry, principles & problems, Tata McGraw Hill, New Delhi, 1990.
6. B.K.Sen “Quantum chemistry “, spectroscopy”
7. K.V.RAMAN “Spectroscopy and mathematics of Quantum chemistry in print.
8. R.Chang “Basic principles of spectroscopy”
9. Dyer “Organic Application of Spectroscopy”
10. Y.R.Sharma. Elementary organic spectroscopy. Principles and Applications. S.Chand. New Delhi (1992).

Exam duration: Three Hours

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

Part B – 5 X 5 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – XII (Major Practical)

Credits	: 4	Code: RR5CHP4
Hors / Week	: 5	
Medium of Instruction	: Both Tamil and English	100 Marks

SEMESTER – VI

(For students admitted from 2015 onwards)

GRAVIMETRIC ANALYSIS – IV

I. Gravimetric Analysis

1. Estimation of calcium as calcium oxalate
2. Estimation of barium as barium sulphate
3. Estimation of barium as barium chromate
4. Estimation of lead as lead sulphate
5. Estimation of lead as lead chromate
6. Estimation of nickel as nickel dimethylglyoxime complex
7. Estimation of Mg as oxinate.

II. Determination of melting and boiling points of simple organic compounds.
 (Without H₂SO₄ medium)

Procedure writing with equations	: 05 marks
Record Note Book	: 05 marks
Practical Examination	: 50 marks
CIA	: 40 marks
Total	: 100 marks

Signature of the HOD

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

Credits	: 4	Code:RR6CHP5
Hors / Week	: 5	
Medium of Instruction	: Both Tamil and English	

SEMESTER – VI
(For students admitted from 2015 onwards)
Physical Chemistry Practical – V

I. Distribution law:

- a. Partition coefficient of Iodine between carbon tetrachl and water
- b. Equilibrium constant of the reactions.

$$I_2 + I^- \rightarrow I_3^-$$

II. Kinetics:

- a. Acid catalysed hydrolysis of an ester (Methyl acetate or Ethyl acetate)

III. Molecular weight :

Rast's method : Naphthalene, m-dinitrobenzene and diphenyl as solvents.

IV. Heterogeneous equilibrium

- a. Critical solution temperature of phenol-water system- effect of impurity on C.S.T. (2% NaCl or 2 % succinic acid solutions).
- b. Simple eutectic system : Naphthalene – Biphenyl, Napthalene Diphernylamine.
- c. Determination of transition temperature : Sodium acetate..H₂O, Na₂S₂O₃.5H₂O, SrCl₂.6H₂O & MnCl₂.4H₂O.

V. Electrochemistry

Conductivity:

Cell constant

Equivalent conductivity

Conductometric titrations

Potentiometry

Potentiometric titrations.

Note :

Procedure writing with formula	: 10 Marks
Record	: 05 Marks
Practical	: 45 Marks
CIA	: 40 marks
Total	: 100 marks

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – MEC3 (Major Elective)

Credits	: 4	Code: RR6CHEL3
Hors / Week	: 4	
Medium of Instruction	: Both Tamil and English	

SEMESTER – VI

(For students admitted from 2015 onwards)

Organic Chemistry - II**UNIT-I****1.1 Nitrocompounds and amines.**

- 1.1.1 Conversion of nitrobenzene to ortho, para and meta dinitrobenzenes. TNT – Aromatic Nitro Compounds – Reduction in neutral, acidic and alkaline media
- 1.1.2 Relative basic characters of Aliphatic and Aromatic amines.
- 1.1.3 Ring substitution in aromatic amines. Diazotisation and its mechanism synthetic applications of diazonium salts.
- 1.1.4 Diazomethane and diazoacetic ester-preparation, structure and their synthetic uses.
- 1.1.5 Phenylene diamines.
- 1.1.6 Sulphanilic acid, sulphanilamide, saccharin, chloramine T.
- 1.1.7 Diamide- preparation, properties and uses of urea and thiourea.

1.2 Amino acids and proteins.

- 1.2.1 Classification of aminoacids. Essential and non-essential amino acids.
- 1.2.2 Preparation of α - amino acids. Properties and reactions. Zwitter ions, Isoelectric points, peptide syntheses. Structure determination of polypeptides. End group analysis.
- 1.2.3 Proteins – Classification based on physical and chemical properties and based on physiological Functions. Primary and secondary structures of proteins. Helical and sheet structures (elementary treatment only) Denaturation of proteins.
- 1.2.4** Nucleic acids : Structures of nucleobases-adenine, guanine, thymine, uracil and cytosine-nucleosides- nucleotides- polynucleotides-types of nucleic acids-DNA and RNA-biological functions.

UNIT – II**2.1. Phenols**

- 2.1.1 Acidic character of phenols, Explanation on the basis of Resonance stabilisation.
- 2.1.2 Ring substitution in phenols – orientation of phenolic group towards electrophiles. Esterification, nitration, sulphonation, halogenation coupling with diazonium salts, Kolbe's reaction, Reimer-tiemann Reactions, Gattermann, Lederer Manasse and Hoesch reactions.
- 2.1.3 Cresols, Nitro and Aminophenols, Di and Trihydric phenols. Alpha and Beta naphthols preparation and properties.

2.2 Dyes

- 2.2.1 Theory of colour and constitution.
- 2.2.2 Classification – according to structure and application

- i) Azodyes – methyl orange and Bismark brown; ii) Triphenyl methane dyes – Malachite green; iii) Phthalein dyes – phenolphthalein and fluorecein. iv) Vat dye – Indigo v) Anthraquinone dye – Alizarin.

2.3. **Pharmaceuticals-** Explanation with two examples each for

- i) Analgesics ii) Antibacterial iii) Anti-inflammatory iv) Antipyretic ,
v) Antibiotic, vi) Antitubercular vii) Antiviral viii) Antitussive ix)
Antiallergic x) Antidiabetics xi) antihypertensive xii) Antiepileptics xiii)
Tranquilizers, xiv) Antiseptic and disinfectant xv) Antimalarial
xvi) Anaesthetics (local and general). SAR (structure activity relationship) of
Chloramphenicol and Phenacetin

UNIT – III

Carbohydrates

- 3.1 Classification, constitution of glucose and fructose. Reactions of glucose and fructose oxazone formation, Mutarotation, and its mechanism, cyclic structure, pyranose and furanose forms. Determination of ring size, formula, configuration of monosaccharides. Epimerisation, chain lengthening, and chain shortening of aldoses. Inter conversion of aldoses and ketoses-Haworth, Fischer and chair conformations of glucose – stability of α and β –glucose—structures of ribose and deoxyribose
- 3.2 Disaccharides – Reactions and structure of maltose, lactose and sucrose. Starch and cellulose structure of starch and cellulose (Haworth) structural elucidation not necessary

UNIT – IV

Natural products

- 4.1 Terpenes, isoprene rule Occurrence and structural elucidation of Geraniol, Nerol, Menthol, and α -terpineol
- 4.2 Alkaloids – General methods of isolation and general methods of structure determination conine, piperine and Nicotine.
- 4.3 Vitamins-Thiamine, Riboflavin, pyridoxine and ascorbic acid occurrence and biological importance. Structural elucidations of pyridoxine and ascorbic acid.

UNIT – V

Molecular Rearrangement

- 5.1 Classification (anionotropic, cationotropic) Intermolecular and intramolecular.
- 5.2 Pinacol – Pinacolone rearrangement (Mechanism, Evidence for carbonium ion intermediate formation – Migratory aptitude) Beckmann, Benzidine, Hofmann, Curtius, Benzilic acid rearrangements (mechanisms only) Claisen Rearrangement (sigmatropic rearrangement) – Evidence for intramolecular nature and allylic carbon attachment para-Claisen rearrangement, Cope and oxy-Cope rearrangements Fries rearrangement (Two mechanisms).

References:

1. P.L.Soni and H.M.Chawla, “Text Book of Organic Chemistry”, 27th edn., Sultan Chand 1997.
2. V.S.Parmar and H.M.Chawla, “Principles of reaction mechanism in Organic Chemistry”, 2nd Edn., Sultan Chand 1978.
3. Subash Chandra Rastogi, Satis Kumar Agarwala Ashok Kumar Sharma, “Chemistry of Natural products” Vol.1 & Vol. II, I Edition 1974-75. Jai Prakash Nath & Co. Leading Educational Publishers.
4. Ernest L Eliel “Stereochemistry of Carbon Compounds”, 19th Reprint 1995 Tata McGraw Hill Publishing company Ltd.
5. M.K.Jain “Organic Chemistry”, 12th Edn., Shoban Lal Nagin Chand and Co.

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 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16)
First Allied Course – I (Allied Theory)

Credits : 3 **Code: RR1ACH1**
 Hors / Week : 4
 Medium of Instruction : Both Tamil and English

SEMESTER – I

(For students admitted from 2015 onwards)

I B.Sc., - Maths, Zoology, Biochemistry and II B.Sc., Physics Major Students

Inorganic, Organic and Physical chemistry – I

UNIT – I

- 1.1. **Molecular Orbital Theory** : Some important basic concepts of M.O theory- LCAO . Bonding and antibonding Orbitals and bond order . Application of MO theory to H₂ , He₂, N₂, O₂ and F₂ Molecules
- 1.2. **Industrial Chemistry** : Fuel gases --Watergas, producer gas, L.P.G gas, Gobar gas and natural gas. Fertilizers- NPK and mixed fertilizers , micronutrients, and their role in plant life and biofertilizers , Soap and detergents an elementary idea about preparation and manufacture Cleaning action of soap and detergents
- 1.3. **Pollution**: Causes , effects and control measures of a)air pollution b) water pollution and c)soil pollution

UNIT – II

- 2.1. **Polar Effects**: Inductive effect- Relative strength of aliphatic monocarboxylic acid and aliphatic amines - Resonance- conditions for resonance, consequences of resonance- resonance energy. Basic property of aniline and acidic property of phenol - Hyper conjugation - consequences of hyperconjugation- Heat of hydrogenation, bond length and dipolemoment. Steric effect – steric accelerated reaction and steric inhibited reaction.
- 2.2. **Halogen Containing Compounds**: Important chlorohydrocarbons used as solvents and pesticides(Dichloromethane, chloroform, carbontetrachloride, DDT, BHC) Fluorocarbons (freons)- preparation , properties and uses
- 2.3. **Types Of Solvents** – polar , nonpolar- dissolving nature .

Unit – III

- 3.1. **Aromatic Compounds**: Structure , stability , resonance and aromaticity of benzene - Typical substitution reaction- i) Nitration ii) Halogenation iii) alkylation. Naphthalene- Isolation, synthesis, properties and structural elucidation and uses

- 3.2. **Organic Reactions:** i) Biuret ii) decarboxylation iii) benzion iv) Perkin v) Cannizaro vi) Claisen vii) Haloform viii) carbylamine ix) coupling reactions
- 3.3. **Chemotherapy:** Explanations with two examples each for i) Analgesics ii) Antibacterial iii) Anti-inflammatory, iv) Antipyretic , v) Antibiotic, vi) Antitubercular vii) Antiviral viii) Antitussive ix) Antiallergic x) Antidiabetics xi) antihypertensive xii) Antiepileptics xiii) Tranquilizers, xiv) Antiseptic and disinfectant xv) Antimalarial xvi) Anaesthetics (local and general). Structures not necessary.

Unit – IV

- 4.1. **Solid State:** Typical crystal lattices – unit cell. Elements of symmetry. Bragg`s equation, Weiss indices, Miller indices, simple, body centered and face centered cubes.
- 4.2. **Energetic:** Review of first law of thermodynamics- state and path functions- need for the second law- Carnot`s cycle and thermodynamic scale of temperature spontaneous and non-spontaneous processes. Elementary idea of third law- statement and explanation.
- 4.3. **Phase Rule:** Phase, component, degrees of freedom, and phase rule definition. One component – water system. Reduced phase rule - two components – Pb-Ag system.

UNIT – V

- 5.1. **Chemical Equilibrium:** Criteria of homogeneous and heterogeneous equilibria. Decomposition of HI, N₂O₄, CaCO₃ and PCl₅
- 5.2. **Chemical Kinetics:** Order of reactions and their determinations. Activation energy, effect of temperature on reaction rate.
- 5.3. **Catalysis :** Types, mechanism of catalytic reactions, industrial applications

References:

1. R.D.Madan, J.S.Tiwari and G.L.Mudhara – A text book of First Year B.Sc.Chemistry – S.Chand & Co.
2. G.S.Manku – Theoretical Principles of Inorganic Chemistry Tata McGraw Hill, New Delhi.
3. Paula Yurkanis Bruice- Organic Chemistry, Prentice Hall
4. D.N.Bajpai – Advanced physical chemistry – S.Chand and Co.

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 = 25 Answer All Questions (Either Or 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Second Allied Course – II (Allied Theory)

Credits	: 4	Code: RR2ACH2
Hors / Week	: 4	
Medium of Instruction	: Both Tamil and English	

SEMESTER – II

(For students admitted from 2015 onwards)

I B.Sc., - Maths, Zoology, Biochemistry and II B.Sc., Physics Major Students

Inorganic, Organic and Physical chemistry – II

UNIT – I

- 1.1. **Coordination Chemistry:** Nomenclature of mononuclear complexes – Werner, Sidgwick, and Pauling's theories. Chelation and its industrial importance to EDTA. Biological role of hemoglobin and chlorophyll. Application of complexes in qualitative and quantitative analysis.
- 1.2. **Metallic Bond:** Electron gas, Pauling and band theories. Semiconductors- intrinsic, n –type and p-type.
- 1.3. **Compounds of Sulphur :** Peroxides of sulphur and sodium thiosulphate

UNIT – II

- 2.1. **Carbohydrates:** Classification- glucose and fructose- preparation and properties – elucidation of structure of glucose- configuration of glucose – Fischer and Haworth cyclic structures.- Sucrose – manufacture and properties- starch and cellulose- properties and uses.
- 2.2. **Amino Acids and Proteins:** Amino acids- classification based on structure and essential and non-essential amino acids preparation and properties – peptides – (elementary treatment)- proteins- classification based on physical properties and biological functions. Structures of proteins-primary and secondary (elementary treatment)

UNIT III

- 3.1. **Synthetic Polymers:** Teflon, alkyd and epoxy resins, poly esters – general treatment only.
- 3.2. **Heterocyclic Compounds:** Furan, thiophen, pyrrole and pyridine – preparation and properties- basic properties of pyridine and pyrrole- quinoline and isoquinoline.

- 3.3. **Stereoisomerism:** Optical isomerism- lactic and tartaric acid-racemic mixture and resolution. Geometrical isomerism – maleic and fumaric acids. Keto-enol tautomerism
Meaning of E, Z, R,S,D, L, meso, (+), (-) and (+-) in stereochemistry.

UNIT IV

- 4.1. **Surface Chemistry:** Emulsions, gels- preparation, properties and applications. Electrophoresis, chromatography- column, paper and thin layer chromatography
4.2. **Photochemistry:** Laws of photochemistry and applications.

UNIT - V

- 5.1. **Electrochemistry:** Specific and equivalent conductivities – their determination – effect of dilution on conductivity. An elementary idea about ionic theory- Ostwald's dilution law, Kohlrausch law, conductivity measurements, conductometric titrations.
5.2. **pH and Buffer:** Importance of pH and buffers in living systems – pH determination by colorimetric and electrometric methods.

References:

1. R.D.Madan, J.S.Tiwari and G.L.Mudhara – A text book of First Year B.Sc.Chemistry – S.Chand & Co.
2. G.S.Manku – Theoretical Principles of Inorganic Chemistry Tata McGraw Hill, New Delhi.
3. B.R..Puri, L.R.Sharma and Madan S.Pathania, “Principles of Physical Chemistry” Shoban Lal Nagin Chand and Co., Delhi.
4. R.D.Madan, “Modern Inorganic Chemistry”, 1987, S.Chand and Company (Private) Ltd.,
5. P.L.Soni, “Text book of Organic Chemistry, Sultan Chand & Co., New Delhi.

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 = 25 Answer All Questions (Either Or 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

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

Allied Course – III (Allied Practical)

Credits	: 5	Code: RR2AHP / RR4AHP
Hours / Week	: 6	
Medium of Instruction	: Both Tamil and English	

SEMESTER – I & II

(For students admitted from 2015 onwards)

PRACTICAL – I : Volumetric & Organic Analysis

(Examination at the End of Semester - II)

(For the B.Sc., Mathematics / Biochemistry / Physics / Zoology Major candidates admitted from the academic year 2011 - 2012 onwards)

I. Volumetric Analysis

1. Acidimetry and alkalimetry
 - a) Strong acid vs strong base
 - b) Weak acid vs strong base
 - c) Determination of hardness of water
2. Permanganimetry
 - a) Estimation of ferrous sulphate
 - b) Estimation of oxalic acid
3. Iodometry
 - a) Estimation of copper
 - b) Estimation of potassium dichromate
 - c) Estimation of potassium permanganate

II. Organic Analysis

A study of the reactions of the following organic compounds

1. Carbohydrate
2. Amide
3. Aldehyde
4. Ketone
5. Acid
6. Amine
7. Phenol

The students may be trained to perform the specific reactions like tests for elements (nitrogen only), aliphatic or aromatic, saturated or unsaturated and functional group present and record their observations.

Note: Org – Qual – Practical : 30 marks

Volumetric Procedure writing	:	05 marks
Volumetric	:	30 marks
Record (Vol. & Org. Qual.)	:	10 marks*
CIA	:	25 marks
Total	:	100 marks

*Minimum of 5 marks may be given

Signature of the HOD

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – III (Skill Based)

Credits	: 4	Code: RR5CHELO1
Hors / Week	: 4	
Medium of Instruction	: Both Tamil and English	

SEMESTER – V

(For students admitted from 2015 onwards)

Agricultural Chemistry

UNIT- I Soil Formation

- 1.1 Soil formation – soil forming processes- profile development – definition of soil – soil composition.
- 1.2 Soil physical properties – soil texture and structure – soil air, soil temperature, soil water, soil consistence – significance of physical properties to plant growth.
- 1.3 Soil chemical properties –soil colloids – Inorganic colloids-clay minerals-amorphous-Ion exchange reactions-organic colloids-soil organic matter-Decomposition-Humus formation-significance on soil fertility, soil reaction-Biological properties of soil-nutrient availability.

UNIT – II Fertilizer

- 2.1 Fertilizer – definition – fertilizer recommendation based on soil testing – fertility index – Effect of Nitrogen on plant growth and development. Phosphate fertilizers – effects of Phosphorous on plant growth and development – super phosphate & Bone meal. Potassium fertilizers – functions of potassium on plant growth.
- 2.2 Secondary and micronutrients fertilizers – complex and mixed fertilizers – sources, manufacture, properties and reactions in soils – slow release fertilizers.

UNIT – III Mannurs

- 3.1. Bio fertilizers - nitrogen fixing bio fertilizers – rhizobium, azospirillum – phosphate mobilizing bio fertilizer – bacteria – bacillus, pseudomonas, fungi – aspergillus, penicillium .
- 3.2. Green manures – green leaf manure – bulky organic and concentrated organic manures – compost – enriched farmyard manures, composting of coir pith ; sugarcane trash, leaf litters and farm wastes – oil cakes, bone meal, fish meal, guano poultry manures.

UNIT – IV Pest management and control

Pesticides – formulations – emulsifiable concentrate, water miscible liquids, wettable powders dusts, granules, classification of pesticides – mode of pesticides in soil and plants – impacts of pesticides mode of action – characteristics – uses – impact of pesticides on environment – safety measure in the analysis and handling of pesticides.

- 4.1 Insecticides – plant products – Nicotine, pyrethrum, rotenone, petroleum oils. Inorganic pesticides – Arsenical fluorides, borates. Organo chlorine compounds – D.D.T, B.H.C, methoxychlor, chloredane, endosulfon.

UNIT – V

Fungicides And Herbicides

- 5.1. Fungicides – Inorganic – Sulphur compounds – Copper compounds – Mercuric Compounds, Organic – dithiocarbomates – Dithane, M.Boredeaux mixture.
- 5.2. Herbicides: Inorganic herbicides – Arsenical compounds Boron Compounds – Cyanmides – Cyanides and thio cyanates, Chlorates and sulphomates. Organic herbicides & Nitro compounds – Chlorinated compounds – 2 -4D – Pyridine Cmpounds –Trizine compounds – Propionic acid derivatives – urea herbicides, Alachlor.
- 5.3. Acaricides – Rodenticides – Attactance – Repellants- Fumigaus Defoliant.

Reference:

1. N.C. Brady, the Nature and properties of soils Eurasia publishing house, (P) Ltd. 9th Ed 1984.
2. Biswas, T.D and Mukeherjee S.K. 1987 Text book of soil science.
3. A.J Daji (1970) A Text book of soil science – Asia publishing house, Madras.
4. Donahue, R.L Miller, R.W. and shickluna, J.C.1987. Soils – An introduction to soils and plant Growth – Pretice Hall of India (P) Ltd., New Delhi.
5. Colling, G.H. 1955, Commercial fertilizers – McGraw Hill Publishing Co., New York.
6. Tisdale, S.L. Nelson, W.L. and Beaton, J.D 1990, Soil fertility and fertilizers. Macmillan publishing company, New York.
7. Hesse, P.R. 1971. A Text book of soil chemical Analysis. Prentice Hall of India, New Delhi.
8. Jackon, M.L 1958, Soil Analysis. Pretice Hall of India (P) Ltd., New Delhi.
9. Buchel, K.H.1983 Chemistry of Pesticides – Jhon wiley & sons, New York.
10. Melnikov, N. N 1971. Chemistry of pesticides Vol.36 of Residue Review- springer verlac.
11. Sree Ramula, U.S. 1979, Chemistry of Insecticides and fungicides – Owford and IBH publishing. Co., New Delhi.

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 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – NMEC2 (Non Major Elective)

Credits	: 4	Code: RR6CHELO2
Hors / Week	: 4	
Medium of Instruction	: Both Tamil and English	

SEMESTER – VI
(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 fertilizer, 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 neutron absorbing glass - Fertilizers: Fertiliser industries in India – manufacture of ammonia – ammonia salt, 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 importance 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. Chakrabarty, 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 Sherrill and Joseph A. Brink Jr., Chemical Process industries, McGraw Hill Industrial Book Company, London
5. A.C.S. Brain, Production and properties of 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 = 25 Answer 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
B.Sc., Chemistry – CBCS Pattern (From the academic year 2015 – 16
Core Course – SB 6 (Non Major Elective)

Credits : 1 **Code: RR4SB2**
 Hors / Week : 2
 Medium of Instruction : Both Tamil and English

SEMESTER – IV

(For students admitted from 2015 onwards)

Chemistry In Every Day Life

UNIT – 1

Cleaning agents – soaps- detergents- types–composition-manufacture –foaming, colouring and building agents . shampoo, washing powder and bleaching powder.
 Water-types-hardness of water- types. Water pollution, causes, prevention.

UNIT – II

Food-importance-spoilages-causes, preservation-additives – colouring, flavouring agents, beverages. Soft drinks, aerated water-manufacturing .
 Fruits,vegetables,dairy products-storage,preservation. Minerals in food - toxins and anti oxidants.

UNIT – III

Cosmetics- Face powder-constituents uses-side effects. Nail polish, hairdye- composition and side effects . Tooth powder- composition and manufacturing .
 Medicines in day- to-day life - analgesics, anti pyretics, anti inflammatory, antibiotics, antiseptic and disinfectants- definition, examples and uses.

UNIT – IV

Corrosion-definition,control. Paints and varnishes-constituents, manufacturing-medium - binder –pigments- types of paints -requirements of a good paints, Polymers-types-plastics.Rubber- vulcanization -application .. Adhesives- composition, manufacturing and uses.

UNIT – V

Building materials –cement- composition –manufacturing- mixture, concrete,RCC- use of steel .
 Fertilizers- fertilizer industries in India .Manufacture of ammonium salts, urea, super phosphates.

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 = 25 Answer All Questions (Either Or type -Two questions from each unit)

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

Signature of the HOD