



# SAIVA BHANU KSHATRIYA COLLEGE

(Aruppukottai Nadargal Uravinmurai Pothu Abiviruthi Trustukku Pathiyapattathu)

(Affiliated to Madurai Kamaraj university)

(Re-accredited with B+ Grade (3rd Cycle) by NAAC)

ARUPPUKOTTAI - 626 101

VIRUDHUNAGAR DISTRICT, TAMIL NADU

DEPARTMENT OF CHEMISTRY

## SYLLABUS

### B.Sc., Chemistry

<b>Year: First Year</b>	<b>Semester: VI</b>
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#### CORE SUBJECT PAPERS

Core Subject	Semester	Subject / Title of the Paper
CS1	I	General Chemistry
CS2	II	Organic Chemistry I
CS3	III	Physical Chemistry I
CS4	IV	Inorganic Chemistry
CS5	V	Organic Chemistry II
CS6	V	Physical Chemistry II
CS7	V	Inorganic, Analytical and Applications of Computers in Chemistry
CS8	VI	Organic Chemistry III
CS9	VI	Physical Chemistry III
CS10	VI	Applied Chemistry

Semester	Part	Course	Title	Hours/Week	Credits
VI	III	Core Course-VIII	Organic Chemistry-III	4	4
		Core Course- IX	Physical Chemistry-III	4	4
		Core Course- X	Applied Chemistry	4	4
		Core practical-III	Organic preparation & gravimetric Estimation	3	5
		Core practical-IV	Org. analysis & Estimation.	3	5
		Core practical-V	Physical Chemistry	2	5
		Allied course – II*		6	5
	IV	Skill Based-V	Medicinal Chemistry	2	2
		Value Education	Value Education	2	2
<b>Total</b>				<b>30</b>	<b>36</b>



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## VI SEMESTER CORE PAPER –VIII ORGANIC CHEMISTRY-III

Credits –4  
Max. Marks 100

Hours/Week: 4  
Ext: 75 + Int: 25

### OBJECTIVES

1. To learn the chemistry of heterocyclic compounds and alkaloids
2. To understand the concept of proteins nucleic acids and terpenes
3. To study the chemistry of dyes and know the applications of synthetic reagents
4. To learn the properties of sulphur containing compounds and the mechanism of molecular rearrangements
5. To study the application of spectral techniques to organic molecules

### UNIT I: HETEROCYCLIC COMPOUNDS AND ALKALOIDS

- a. Heterocyclic compounds: Classification - preparation and reactions of thiophene, furan, pyrrole, pyridine, quinoine and isoquinoline.
- b. Alkaloids: Definition- occurrence and extraction of alkaloids, classification of alkaloids, structure elucidation and synthesis of the following alkaloids - conine, piperine and nicotine.

### UNIT II: PROTEINS, NUCLEIC ACID AND TERPENES

- a. Preparation of amino acids using Gabriel's phthalimide synthesis, Zwitter ion
- b. Classification and colour reactions of proteins- primary, secondary, tertiary and Quarternary structure of proteins (an elementary idea only).
- c. Nucleic acids, nucleosides, nucleotides, RNA and DNA (an elementary idea about their Structure.)
- d. Terpenes: Classification, occurrence and isolation- general properties- isoprene rule – synthesis and structural elucidation of citral, geranial, menthol and terpeniol.

### UNIT III: DYES AND SOME SYNTHETIC REAGENTS

- a. Dyes: Theory of colour and constitution, classification of dyes on the basis of their structure and applications. Preparation of malachite green, rosaniline, phenolphthalein, fluorescein, indico, alizarin, methyl orange and congo red.
- b. Synthetic applications of Grignard reagents,  $\text{LiAlH}_4$  and  $\text{SeO}_2$ .
- c. Synthetic applications of acetoacetic ester and malonic ester.



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### UNIT IV: SULPHUR CONTAINING ORGANIC COMPOUNDS AND MOLECULAR REARRANGEMENTS.

- Thioalcohols and thioethers: Preparation of thiols from alcohol, and its oxidation reactions - Preparation of sulphanol and mustard gas.
- Aromatic sulphonic acids: Preparation, reactions of benzene sulphonic acids. Preparation and uses of saccharin, chloramine-T and dichloramine-T
- Molecular rearrangements: Detailed mechanisms of the following: pinacol- pinacolone, Hofmann, Curtius, benzil-benzilic acid, Claisen, Beckmann, benzidine, and Fries rearrangement

### UNIT V: PRINCIPLES AND APPLICATIONS OF SPECTROSCOPY

- UV-VIS. spectroscopy: Types of electronic transitions, absorption laws, bathochromic shift and hypsochromic shift, hyperchromic and hypochromic effect, applications of UV to organic compounds, Woodward-Fieser rules- calculation of ( $\lambda_{max}$ ) for conjugated dienes
- IR spectroscopy: Instrumentation- Modes of vibration, overtone and combination of bonds, applications of IR to organic compounds-finger print region, study of hydrogen bond.
- NMR spectroscopy: Introduction- chemical shift – shielding and deshielding effects - factors affecting the chemical shift- solvent used, splitting of signals- NMR spectra of ethanol, benzaldehyde, isopropyl alcohol and mesitylene

### TEXT BOOKS

- A. Bahl and B.S. Bahl, Advanced Organic Chemistry, 1<sup>st</sup> Multicolour Edition, S. Chand & Company, New Delhi, 2010.
- S.C. Sharma and M.K. Jain, Modern Organic Chemistry, Vishal Publishing Company, New Delhi, 2014.
- K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, A Textbook of Organic Chemistry, 2<sup>nd</sup> Edition, Vikas Publishing House (Pvt.) Ltd., New Delhi, 2004.

### REFERENCE BOOKS

- I.L. Finar, Organic Chemistry Vol. II, 5<sup>th</sup> Edition, Pearson Education, New Delhi, 2013.
- R.M. Silverstein and F.X. Webster, Spectrometric Identification of Organic Compounds, 6<sup>th</sup> Edition, John Wiley and Sons, New York, 2004.
- Y.R. Sharma, Elementary Organic Spectroscopy, 4<sup>th</sup> Edition, S. Chand & Company Ltd., New Delhi, 1012 (Reprint)
- P.S. Kalsi, Organic Reactions, Stereochemistry and Mechanism, 4<sup>th</sup> Edition, New Age International Publishers, New Delhi, 2006.



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DEPARTMENT OF CHEMISTRY

Core Paper –IX

PHYSICAL CHEMISTRY III

Credits –4

Max. Marks 100

Hours/Week: 4

Ext: 75 + Int: 25

## OBJECTIVES

1. To learn about rate, order and theories of reaction rate
2. To understand principles of various types of spectroscopy
3. To know the concept of thermodynamics of ideal solutions
4. To understand about emf and electrochemical cells
5. To learn the fundamentals of photochemistry

## UNIT I: CHEMICAL KINETICS

- a. Rate- order- rate law- rate constants- Simple reactions involving zero, first, second and third – order reactions. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction.
- b. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction.
- c. General methods for determination of order of a reaction.
- d. Concept of activation energy and its calculation from Arrhenius equation.
- e. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Lindeman hypothesis.

## UNIT II: SPECTROSCOPY

- a. Introduction - Distinguishing (i) emission and absorption spectra (ii) atomic and molecular spectra – regions of e.m. spectrum in terms of wave length – conversion to wave number, frequency and energy
- b. Pure rotational spectroscopy -Definitions of rigid rotors,– derivation of equation for moment of inertia, I- equation for rotational energy levels –rotation constant (B) – rotational selection rules - calculation of inter atomic distance
- c. Pure vibrational spectroscopy - normal modes in CO<sub>2</sub> and H<sub>2</sub>O– potential energy versus displacement diagram for HCl –zero point energy – vibrational selection rules – vibration spectrum of an ideal harmonic oscillator – calculation of force constant – meaning of fundamental vibrational transitions, hot bands and overtone spectroscopy
- d. Raman spectroscopy- Stokes and anti stokes lines-Comparison with IR
- e. Electronic spectroscopy–Franck Condon principle
- f. Principle of NMR-Chemical Shift- Principle of EPR –hyperfine splitting of H<sup>+</sup> ion

## UNIT III: SOLUTIONS

- a. Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions.



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- b. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation.
- c. Nernst distribution law and its applications.

### UNIT IV: ELECTRO CHEMICAL CELLS

- a. Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance.
- b. Types of electrodes. Standard electrode potential. Electrochemical series.
- c. Thermodynamics of a reversible cell, calculation of thermodynamic properties:  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  from EMF data. Calculation of equilibrium constant from EMF data.
- d. Concentration cells with transference and without transference. Liquid junction potential and salt bridge.
- e. pH determination using hydrogen electrode and quinhydrone electrode.
- f. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).
- g. Commercial cells: Dry cell, lead storage, alkali (Na-S) and H<sub>2</sub>-O<sub>2</sub> fuel cells- lithium ion battery.

### UNIT V: PHOTOCHEMISTRY

- a. Introduction - Difference between thermal and photochemical processes - Beer Lambert's law. Laws of photochemistry: Grothus-Draper law and Stark-Einstein's law of photochemical equivalence. Quantum yield and its explanation and determination
- b. Photosynthesis –Kinetics of Photochemical reaction of hydrogen-chlorine and hydrogen-bromine reactions.
- c. Photophysical processes: Jablonski diagram – Fluorescence – Phosphorescence. Non-radiative processes: Internal conversion and inter system crossing.
- d. Photosensitization – Chemiluminescence and bioluminescence -Chemistry of vision.

### TEXT BOOKS

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46<sup>th</sup> Edition, Vishal Publishing Company, New Delhi, 2013.
2. P.L. Soni, O.P. Dharmarha and U.N. Dash, Textbook of Physical Chemistry, 23<sup>rd</sup> Edition, Sultan Chand & Sons, New Delhi, 2011.
3. R.L. Madan, G. D. Tuli, Physical Chemistry, S. Chand, Revised edition, 2014

### REFERENCE BOOKS

1. S. Glasstone and D.H. Lewis, Elements of Physical Chemistry, 2<sup>nd</sup> Edition, Macmillan &Company, UK, 1962.
2. P.W. Atkins, Physical Chemistry, 8<sup>th</sup> Edition, Oxford University Press, New Delhi, 2006.
3. P.W. Atkins, J. D. Paula Elements of Physical Chemistry, Oxford University Press, 2017



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## DEPARTMENT OF CHEMISTRY

### CORE PAPER –X APPLIED CHEMISTRY

Credits –4

Max. Marks 100

Hours/Week: 4

Ext: 75 + Int: 25

#### OBJECTIVES

1. To learn about the analysis and treatment of waste water
2. To understand the various fuels and their applications
3. To learn about match industry
4. To understand about silicate industry
5. To learn the fundamentals of polymer chemistry

#### UNIT I: WATER AND SEWAGE TREATMENT

- a. Water Quality analysis - chemical and physical analysis of water, Quality parameter Seawater as a source of Drinking water - Electro Dialysis method, Reverse osmosis method for purification of water.
- b. Sewage Treatment -Municipal Waste water - Sewage treatment - Aerobic and Anaerobic processes.

#### UNIT II: FUELS AND COMBUSTION

- a. Fuels - Definition , Characteristics of a good fuel , Calorific value , Coal , Varieties of coal , liquid Fuels Gaseous fuels -Preparation and specific uses of producer gas, Water gas, LPG and gobar gas. Advantages and disadvantages of solid, liquid and gaseous Fuels.
- b. Rocket fuels - classification of solid propellants , Liquid propellants mono - bipropellants).- Combustion - Spontaneous ignition temperature (SIT) - combustion calculation.

#### UNIT III: MATCH INDUSTRY

Raw materials - Types of matches - Composition of match head striking surface manufacture of safety matches - Pyrotechnics - Colored matches.  
Pyrotechnics and explosives , Classification of explosives, Requirements and classification of a good explosives TNT, RDX , Picric acid, Gun powder , Ammonium nitrate.

#### UNIT IV: SILICATE INDUSTRY AND INDUSTRIAL COATINGS

- a. Silicate industry- Cement, Glass and Gypsum, Rawmaterials and Manufacture of cement, Glass.
- b. Industrial Coatings- protective coatings, Metallic coatings, non-metallic coatings, Inorganic coatings, organic coatings, - Paints - composition of paints , pigments - lacquers - Varnishes.

#### UNIT V: POLYMER CHEMISTRY AND RUBBER

Polymer chemistry - Types of polymerization - Addition and condensation polymerization - properties of polymers – structure and uses of polyurethane-polyester-polymethyl methacrylate- plastics, classification of plastics.



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Difference between thermo plastics of thermo setting plastics - Applications of plastics in industry. Rubber: Natural Rubber — preparation from latex- defects of natural rubber, vulcanization of rubber, synthetic rubber preparation and application of Neoprene, Buna – S, Thiokol.(specific uses only)

### TEXT BOOKS

1. R. Gopalan. P. S. Subramanian and K. Rengarajan. Elements of Analytical Chemistry, Sultan Company (2008).
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 31<sup>st</sup> Edition, Milestone Publishers and Distributors, New Delhi, 2013.

### REFERENCE BOOKS

1. A text book of quantitative inorganic analysis, Arthur Vogel. Latest Edition 2006.
2. R. D. Madan. Advanced inorganic chemistry Latest Edition 2006.
3. B.K. Sharma (Goel Publishing House) Latest Edition 2006
4. I.L. Finar, Organic Chemistry Vol. I, 6<sup>th</sup> Edition, Pearson Education, New Delhi, 2014.

### PART IV: SKILL BASED COURSE- VI MEDICINAL CHEMISTRY

Credits –2

Max. Marks 100

Hours/Week: 2

Ext: 75 + Int: 25

### OBJECTIVES

1. To learn about method of analysis of blood and urine
2. To understand vitamins, hormones and enzymes
3. To know the various types of drugs
4. To learn about diabetes and AIDS
5. To know the medicinal values of some plants

### UNIT I

Health and Biochemical Analysis: Definition of health - WHO standard - Biochemical analysis of urine and serum. Blood: Composition, grouping and Rh factor - Blood transfusion

### UNIT II

Vitamins (name, classification, source, function and deficiency diseases) - Enzymes (classification, characteristics, function and examples) – Hormones (classification, organ of secretion and functions)

### UNIT III

Drugs & Pharmaceuticals: Drug discovery, design and development; Basic Retrosynthetic approach. Definition, example and structure the following classes of drugs: analgesics



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agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone),

### UNIT IV

Diabetes and Hypoglycemic drugs: Introduction, Types and control of diabetics; Insulin; oral hypoglycemic drugs; sulphonyl urea; biguanide drugs. AIDS – General symptoms of AIDS- prevention treatment

### UNIT V

Indian Medicinal Plants: Kizhanelli, Hibiscus, Adathodai, Thuduvalai, Thulasi, Brahmi, Aloe Vera and Neem plant (major chemical constituents and medicinal uses). Essential Oils: Extraction by steam distillation – Source and medicinal uses of eucalyptus oil, Sandalwood oil and lemon grass oil.

### REFERENCE BOOKS

1. Guyton and Hall, Textbook of Medical Physiology, 12th Edition, Saunders, US, 2010.
2. B.L. Oser, Hawk's Physiological Chemistry, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1979.
3. Gurdeep R. Chatwal, Synthetic Drugs, Himalaya Publishing House, Bombay, 1995.
4. Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry, 3<sup>rd</sup> Edition, S. Chand and Company Ltd., New Delhi, 1999.
5. S.C Rastogi, Biochemistry, 2nd Edition, Tata McGraw Hill Publishing Co., New Delhi, 2007





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## DEPARTMENT OF CHEMISTRY

### SEMESTER VI PRACTICAL - III

Credits – 5  
Max. Marks 100

Hours/Week: 3  
Ext: 75 + Int: 25

#### Objectives

1. To enable the students to develop skills in quantitative estimation by gravimetric method
2. To learn the art of synthesizing organic compounds.

#### 1. GRAVIMETRY

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of nickel as NiDMG

#### 2. ORGANIC PREPARATION

1. Nitration: picric acid from phenol
2. Bromination: p-bromoacetanilide from acetanilide
3. Hydrolysis: Aromatic acid from an ester/amide
4. Oxidation: Benzoic acid from benzaldehyde
5. Benzoylation of amine/phenols
6. Acetylation of amine/phenols

Scheme of evaluation (Max. marks 100)

Internal Assessment: 40 Marks

Regularity	20 Marks
Class Test	15 Marks
Observation Note	5 Marks
Total	40 Marks

External Examination: 60 Marks (6 hours)

Record Note Book	10 marks		
Gravimetric estimation	30 Marks	Organic Preparation	20 Marks
Procedure	10 Marks	Procedure	6 Marks
Estimation	20 Marks	Crude sample	10 Marks
< 2 %	20 Marks	Recrystallised sample	4 Marks
2 -3%	15 Marks		
3- 4%	10 Marks		
> 4%	5 Marks		



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DEPARTMENT OF CHEMISTRY

## SEMESTER VI PRACTICAL - IV

### ORGANIC ANALYSIS AND ESTIMATION

Credits – 5  
Max. Marks 100

Hours/Week: 3  
Ext: 75 + Int: 25

#### Objectives

1. To enable the students to develop analytical skills in organic qualitative analysis
2. At the end of the course, the students should be able to plan the experimental projects and execute them.

#### 1. Organic Analysis

- a. Identification of acidic, basic, phenolic, and neutral organic substances.
- b. Detection of N, S and halogens.
- c. Test for aliphatic and aromatic nature of substances.
- d. Test for saturation and unsaturation.
- e. Identification of functional groups: i) Carboxylic acids ii) Phenols iii) Aldehydes iv) Ketones v) Esters vi) Carbohydrates vii) Amines viii) Amides ix) Halogen compounds
- f. Preparation of derivatives for the functional groups.

#### 2. Organic Estimation

- a) Estimation of aniline
- b) Estimation of phenol
- c) Estimation of glucose

**Scheme of evaluation (Max. marks 100)**

**Internal Assessment: 40 Marks**

Regularity	20 Marks
Class Test	15 Marks
Observation Note	5 Marks
Total	40 Marks

**External Examination: 60 Marks (6 hours)**

Record Note Book	10 marks		
Organic Estimation	25 Marks	Organic Analysis	25 Marks
Procedure	10 Marks	Elements present	8 Marks
Estimation	15 Marks	Aliphatic/aromatic	4 Marks
< 2 %	15 Marks	Saturated/unsatd.	4 Marks
2 -3%	12 Marks	Functional group	6 Marks
3- 4%	10 Marks	Derivative /color reaction	3 Marks
> 4%	5 Marks		



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## DEPARTMENT OF CHEMISTRY

SEMESTER VI

PRACTICAL - V

### PHYSICAL CHEMISTRY EXPERIMENTS

Credits –5

Max. Marks 100

Hours/Week: 2

Ext: 75 + Int: 25

#### Objectives

1. To apply the principles of physical chemistry and do some experiments
2. At the end of the course, the students should be able to plan the experimental projects and execute them.

1. **Rast Method**- Determination of cryoscopic constant (Kf) of solid solvent using a solute of known molecular mass. Determination of molecular mass of the solute using a solvent of known cryoscopic constant (Kf).

Solid solvents: Naphthalene, biphenyl, camphor. Solutes: Naphthalene, biphenyl, 1,4 dichlorobenzene, diphenylamine, acetanilide, benzophenone

2. **Transition Temperature** - Determination of molal transition point depression constant (Kt) of salt hydrate using solute of known molecular mass. Determination of molecular mass of the solute using a solvent of known molal transition point depression constant (Kt).

Salt hydrates:  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ ,  $\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$ . Solutes: Urea, Glucose

3. **Phase Equilibria** - Construction of phase diagram & determination of eutectic composition and eutectic temperature.

Naphthalene-biphenyl system, Naphthalene-diphenylamine system, Biphenyl-diphenylamine system. Naphthalene – m- dinitrobenzene system

4. **Critical solution temperature** –Determination of CST of phenol-water system-

Influence of NaCl impurity on miscibility temperature of phenol–water system and determination of concentration of given NaCl solution

5. **Thermochemistry** – Heat of solution – potassium dichromate – ammonium oxalate – oxalic acid

6. **Kinetics** – Determination of relative strength of acids by acid catalysed hydrolysis of ester – inversion of cane sugar

7. **Potentiometric titration** – (i)  $\text{KMnO}_4$  Vs  $\text{Fe SO}_4$  (ii)  $\text{K}_2\text{Cr}_2\text{O}_7$  Vs  $\text{Fe SO}_4$

8. **Conductometric titration**

9. **Partition Coefficient Experiment**

10. **Viscosity** – Determination of composition of unknown mixture



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### Scheme of evaluation (Max. marks 100)

Internal Assessment 40 Marks

External Examination: 60 Marks (6 hours)

Regularity	20 Marks
Class Test	15 Marks
Observation Note	5 Marks
Total	40 Marks

Record note	10 Marks
Ability to complete the experiment	30 Marks
Graph/calculation	10 Marks
Tabulation	5 Marks
Result	5 Marks