VIVEKANANDA COLLEGE

(Residential & Autonomous -A Gurukula Institute of Life Training)

(Affiliated to Madurai Kamaraj University)

Re-accredited with 'A' Grade (CGPA 3.59 out of 4) by NAAC

TIRUVEDAKAM WEST

MADURAI DISTRICT – 625 234

POST GRADUATE AND RESEARCH
DEPARTMENT OF CHEMISTRY

SYLLABUS

M.Sc. Chemistry

Choice Based Credit System

(For those who joined in June 2017 and after)

ABOUT THE COLLEGE

Vivekananda College was started by Founder-President Swamiji Chidhbhavanandhaji Maharaj of Sri Ramakrishna Tapovanam, Tirupparaithurai, Trichy in 1971 on the banks of the river Vaigai which is blissfully free from the noise and hurry, the crowds and distraction of the city.

Vivekananda College is a residential college functioning under Gurukula pattern. It is Man-making education that is imparted in this institution, Culture, character and curriculam are the three facets of ideal education that make man a better man. This is possible only when the teacher and taught live together, The Gurukula system of Training is therefore a humble and systematic attempt in reviving the age old GURUGRIHAVASA for wholesome education, Attention to physical culture, devotion to duty, obidence to teachers, hospitality to guests, zest for life, love for the nation, and above all, humility and faith in the presence of God etc. are the values sought to be inculcated. All steps are taken to ensure the required atmosphere for the ideal life training.

Vivekananda College, Tiruvedakam West, Madurai District-625 234 is an aided college established in 1971 and offers UG and PG courses. This College is affiliated to the Madurai Kamaraj University, Madurai. The College was reaccredited with 'A' grade (CGPA 3.59 out of 4.00) by NAAC in March 2015.

VISION AND MISSION

Our Vision: To raise an army of neo-graduates steeped in the hoary culture of the motherland and dedicated to serving her as potential leaders in the manifold spheres of national effort.

Our Mission: A harmonious enrichment of physical, emotional and intellectual facets of a student's personality to bring out his inherent PERFECTION.

OBJECTIVES OF THE INSTITUTION

1. To inculate spiritual, ethical, moral and social values in all disciplines of study.
2. Simultaneous education of the Hand, Heart and Head. Only a sound body can hold a sound mind.
3. Provide opportunities for all round development of the students and excellence in higher education, research and extension in different disciplines.
4. Disseminate the findings of research to the community to facilitate its development.
5. To provide society citizens of sterling character.
6. To cater to the needs of the educationally backward people – the most backward, scheduled caste and tribe.

GURUKULA ADMINISTRATIVE SET UP

Secretary	**Swami Niyamananda Maharaj**
Principal	**Dr. B. Ramamoorthy**
Vice-Principal & NAAC Coordinator	**Dr. S. Raja**
Academic Affairs	**Dr. M. Ganesan**
Controller of Examinations	**Dr. E. Jayakumar**
IQAC Coordinator	**Dr. S. Raja**
IGNOU Coordinator	**Sri. V. Parthasarathy**
ICT Coordinator	**Dr. N.Nagendran**
Grievence Cell Coordinator	**Dr. T. Kaliappan**
Director, Certificate Courses	**Dr. N. Nattuthurai**
Sessional Examination	**Sri. P. Muthukumaran, HOD of Maths**
	Sri. P. Natarajan
	Sri. G.Sanjeevi
	Sri. C. Rajan
	Sri. P. Madasamy

I Eligibility for Admission

Admission to M.Sc. – Chemistry Programme is open to candidates with B.Sc., Chemistry or an examination accepted as equivalent there to by the Syndicate of the MKU, subject to such conditions as may be prescribed therefore.

II Duration

The course is for a period of two years. Each academic year shall comprise of two semesters viz. Odd and Even semesters. Odd semesters shall be from June to November and Even Semesters shall be from December to April. There shall be not less than 90 working days which shall comprise 450 teaching clock hours for each semester (Exclusive of the days for the conduct of university end-semester examinations) for each semester.

III CBCS System

All Programmes offered in the college are run on Choice Based Credit System (CBCS). It is an instructional package developed to suit the needs of students to keep pace with developments in higher education and the quality assurance expected of it in the light of liberalization and globalization in higher education.

IV Semesters:

An academic year is divided into two semesters. In each semester, courses are offered in 15 teaching weeks. Each week has 30 working hours spread over 6 days a week.

V Credits:

The term 'Credit' refers to the weightage given to a course, usually in relation to the instructional hours assigned to it. The total minimum credits, required for completing the M.Sc., Programme is 90. The details of credits for individual components and individual courses are given in the above table.

***VI Course*:**

Each Course is to be designed variously under lectures / laboratory / seminar / practical training / assignments to meet effective teaching and learning needs.

VII Examinations:

i). There shall be examinations at the end of each semester, for odd semesters in the month of October / November; for even semesters in April/May. A candidate who does not pass the examination in any course(s) shall be permitted to appear in such failed course{s) in the subsequent examinations to be held in October / November or April/May.

ii). A candidate should get registered for the first semester examination. If registration is not possible owing to shortage of attendance beyond condonation limit / regulations prescribed or belated joining or on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after the completion of the programme.

VIII Condonation

Students must have 75% of attendance in each paper for appearing the examination. Students who have 65% to 74% of attendance shall apply for condonation in the prescribed form with the prescribed fee. Students who have 50% to 64% of attendance shall apply for condonation in prescribed form with the prescribed fee along with the Medical Certificate. Students who have below 50% of attendance are not eligible to appear for the examination. They shall compensate the shortage after the completion of the programme.

IX Question Paper Pattern

Time: 3 Hours

Maximum Marks: 75

SECTION-A (10 X 2 =20 Marks)

Answer All Questions

(1-10) Short Answer Questions

Two questions from each unit

SECTION-B (5 X 5 = 25 Marks)

Answer All Questions

(11-15) Questions shall be in the format of either (a) or (b)

One question from each unit

SECTION-C (3 X 10 = 30 Marks)

Answer any THREE Questions

(16-20) One question from each unit.

X Evaluation:

Performance of the students are evaluated objectively. Evaluation is done both internally and externally. They will be assessed continuously through Internal Assessment System and finally through summative (end) semester examination. To assess internally, there will be three examinations conducted centrally with a duration of two hours for each paper. In addition to continuous evaluation, the summative semester examination, which will be a written examination of three hours duration, would also form an integral component of the evaluation. The ratio of marks to be allotted to continuous internal assessment and to end semester examination is 25 : 75.

The pattern of internal valuation shall be:

Test: 15 Marks (the average of best two tests out of three tests)
Assignment: 5 marks
Seminar : 5 Marks
Total: 25 marks.

In respect of practical papers, the ratio of marks to be allotted to internal assessment and to summative (end) semester examination is 40 : 60. The internal marks will be calculated on the basis of marks secured at the model examination and marks awarded for the preparation of practical note book. The external marks will be calculated on the basis of the marks awarded by the internal examiner and the external examiner at the summative semester examination.

XI Passing Minimum:

There is no passing minimum for Internal Assessment. The passing minimum for external Examinations shall be 34 out of 75 marks and passing minimum for a paper is 50%.

XII Classification of Students:

Candidates who have secured not less than 40% of marks in each paper shall be declared to have passed in that paper. Candidates who obtain 40% and above but below 50% shall be declared to have passed in Second Class. Candidates who obtain 50% and above but below 60% of the aggregate marks in Part-III shall be declared to have passed in Second Class and those who obtain 60% of marks and above shall be placed in the First Class. Candidates who obtain 75% and above shall be declared to have passed in Distinction provided he has not re-appeared for any paper during the course of the study.

XIII Failed Candidates:

A candidate who has arrears in any paper in a semester examination will be permitted to proceed to the next semester classes. A candidate who has arrears may appear again in these failed papers at the November/April examinations. The internal assessment marks already obtained by him shall be carried over for the subsequent appearance also.

XIV Improvement of Internal Marks:

The student desirous of improving the internal assessment marks may request the Head of the Department. After obtaining permission from the Staff Council Meeting by the Head, the student may write improvement examinations in consultation with the course teacher. The marks obtained (when it is more than the previous marks) will be submitted to the Controller of Examinations for further adoption.

XV Study Tour

Students are expected to participate in the field visit and the study tours organized by the department. Though study tour/field trip carries no credit, it is compulsory for the students to attend whereby the students can get an opportunity to gain practical knowledge. As such, observational visit to selected social welfare organizations, industries, trade centres, exhibitions, places of historical importance and the like will be considered as extra-curricular activities.

POST GRADUATE AND RESEARCH DEPARTMENT OF CHEMISTRY
VIVEKANANDA COLLEGE –TIRUVEDAKAM WEST, MADURAI

Statement of Vision

The Chemistry Department is dedicated to

- Provide a comprehensive, relevant curriculum to the students of chemistry department
- Produce knowledgeable graduates for careers in academia, industry and government,
- Conduct significant research in chemistry,
- Promote the collegial exchange of ideas, independent thought and the highest ethical standards.

Statement of Mission:

The mission of Department of Chemistry is to advance the chemical sciences through the education of students by providing them with quality classroom, research and service opportunities. With a high standard for excellence in all three areas the department will produce students who are knowledgeable in chemistry and can think critically.

In support of our mission the Chemistry Department faculty members strive to:

- Act as mentors to students through advising them in research.
- Teach students the value of cross-disciplinary thinking by providing them with educational and research opportunities between chemistry and other fields of study.
- Promote innovative curriculum development while exposing students to advanced instrumentation and technology.
- Foster multi-disciplinary curriculum development to provide students with a breadth of course options in Forensic Chemistry, Biochemistry, Natural Product Chemistry, Environmental Science, Polymer Science and Chemical Education.
- Encourage community engagement by providing students with service-learning and community-based research opportunities.
- Serve as good role models to students for safe and ethical professional behaviour.
- Encourage students to value diversity and to develop a global perspective through international experiences in chemistry.

The mission of the Department of Chemistry is to create and maintain programs of excellence in the areas of research, education and public outreach. Our goals are (1) continue to attract, develop and retain world-renowned faculty, (2) maintain state of the art research and teaching facilities, (3) recruit outstanding

graduate students, (4) provide innovative, dedicated classroom instruction at both the graduate and undergraduate levels, and (5) communicate the excitement of chemistry to the public at large. To help us accomplish these goals we remain dedicated to a core set of values: excellence in teaching and research, respect for all members of the Department and University, diversity in our students, faculty and staff and service to the citizens of the world.

HISTORY OF THE POST GRADUATE AND RESEARCH DEPARTMENT OF CHEMISTRY

VIVEKANANDA COLLEGE TIRUVEDAKAM WEST, MADURAI

The under graduate Department of Chemistry was started in the year 1981 and elevated as Postgraduate department in the year 2003. From the year 2005 the department has become a full fledged research centre as approved by the Madurai Kamaraj University, Madurai. The department glorified its ventures by conducting 19 MTCs (Modern Trends in Chemistry) seminars /symposia, from 1993. In addition to the teaching activities, the department is known for its research works in thrust areas like Green Chemistry, Coordination Chemistry, Supramolecular Chemistry, BioinorganicChemistry, Corrosion Science and Photochemistry. There are four major research projects have completed one funded by CSIR and the other three supported by UGC. One minor project funded by UGC is being carried out.

We have endowed with the following state of the art instruments:

S.No	Name of Equipment	Model or Make
1	UV-Visible Spectrophotometer	JASCO -V530
2	Spectro Fluorimeter	JASCO - FP6200
3	CH - Electrochemical Workstation	CHI6087D
4	Rotavapor and Vaccum pump	BUCHI
5	Oven	NSW-143
6	Progammalbe Hot Air Oven	THERMOCON
7	UltraSonic Bath Sonicator	PCI Analytics
8	Vaccum Pump	RIVO TEK
9	Visible Annular type Photo Reactor	HERBER
10	Doubled distilled Water Set	Easy Still Mark 2000-DDQXL
11	Low temperature Bath	JULABO F32

FACULTY MEMBERS

Dr. M.GANESAN, M.Sc., M.Phil., Ph.D
HEAD & Associate Professor of Chemistry

Sri. B. SERVARAMUTHU, M.Sc., NET., (Deputed for Ph.D research under FDP)
Assistant Professor of Chemistry

Sri. A. KANNAN, M.Sc., NET
Assistant Professor of Chemistry

Dr. M. GANAPATHI, M.Sc., M.Phil., B.Ed., Ph.D.,
Assistant Professor of Chemistry

Dr. K. NAGARAJ, M.Sc., M.Phil., PGDCA., Ph.D., (FDP Substitute Teacher)
Assistant Professor of Chemistry

Sri. M. RAGU, M.Sc.,
Assistant Professor of Chemistry

Sri. D. THIRUPPATHI, M.S.c., M.Phil.,
Assistant Professor of Chemistry

Sri. G. BALAKRISHNAN, M.Sc., B.Ed.,
Assistant Professor of Chemistry

Sri. G. RAJKUMAR, M.Sc., SET., NET.,
Assistant Professor of Chemistry

SCHEME OF EXAMINATION

Choice Based Credit System

M.Sc. Chemistry

Part	Study Component	Subject Code	Title of the Paper	Hours	Credit	Sessional Marks	Summative Marks	Total
III	Core	33CT11	Organic Chemistry – I	5	4	25	75	100
	Core	33CT12	Inorganic Chemistry – I	5	4	25	75	100
	Core	33CT13	Physical Chemistry – I	5	4	25	75	100
	Core	33CP14	Practical I : Organic analysis	5	3	40	60	100
	Core	33CP15	Practical II: Inorganic analysis	5	3	40	60	100
	Elective	33EP1A 33EP1B	Computer Applications in Chemistry / Environmental Science	5	5	25	75	100
			TOTAL	**30**	**23**			

SECOND SEMESTER

Part	Study Component	Subject Code	Title of the Paper	Hrs	Crd.	Seess Marks	Summ. Marks	Total
III	Core	33CT21	Organic Chemistry – II	5	4	25	75	100
	Core	33CT22	Inorganic Chemistry – II	5	4	25	75	100
	Core	33CT23	Physical Chemistry – II	5	4	25	75	100
	Core	33CP24	Organic Quantitative Estimation	5	3	40	60	100
	Core	33CP25	Practical Physical Chemistry	5	3	40	60	100
	Elective	33EP2A 33EP2B	Medicinal and Pharmaceutical Chemistry / Biochemistry	5	5	25	75	100
			TOTAL	**30**	**23**			

THIRD SEMESTER

Part	Study Component	Subject Code	Title of the Paper	Hours	Credit	Sessional Marks	Summative Marks	Total
III	Core	33CT31	Organic Chemistry – III	5	4	25	75	100
	Core	33CT32	Inorganic Chemistry – III	5	4	25	75	100
	Core	33CT33	Physical Chemistry – III	5	4	25	75	100
	Core	33CP34	Practical V: Inorganic Quantitative Estimation	5	3	40	60	100
	Core	33CP35	Practical VI: Physical Chemistry	5	3	40	60	100
	Non Major	33NE3A 33NE3B	Forensic Chemistry / Polymer Chemistry	5	5	25	75	100
			TOTAL	**30**	**23**			

Note : All Practical Examinations – 6 Hours

FOURTH SEMESTER

Part	Study Component	Subject Code	Title of the Paper	Hrs	Crd.	Seess Marks	Summ. Marks	Total
III	Core	33CT41	Organic Chemistry – IV	5	4	25	75	100
	Core	33CT42	Inorganic Chemistry – IV	5	4	25	75	100
	Core	33CT43	Physical Chemistry – IV	5	4	25	75	100
	Core	33PV41	Project And Viva-Voce	10	4		100	100
	Elective	33EP4A 33EP4B	Introduction to Nano Science/ Chemistry for National Eligibility Test	5	5	25	75	100
			TOTAL	**30**	**21**			
			TOTAL HOURS	**120**				
			TOTAL CREDIT		**90**			

Note: All Practical Examinations – 6 Hrs.

SEMESTER I
(For those who joined in June 2017 and after)

Part III - Core Subject Theory – I		
Subject Title **: Organic Chemistry - I**		
Subject Code: 33CT11	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To be familiar with fundamentals concept of electron displacement effect*
- *To have basic idea of aromaticity*
- *To understand the explore to concept of stereochemistry*
- *To understand the principles of conformational analysis*
- *To know about the chemistry of carbohydrates and terpenoids*

UNIT I: ELECTRON DISPLACEMENT EFFECT 15 Hrs

Inductive effect delocalized chemical bonding – resonance, rules of resonance, conjugation, cross conjugation, hyper conjugation, steric effect and hydrogen bonding. Effects of structure on reactivity-strength of acids and bases, steric effect, quantitative treatment. The Hammett equation and linear free energy relationships, substituent and reaction constants. Taft equation. Bonds weaker than covalent – addition compounds, crown ether, complexes – cyclodextrin calexeris and cryptands – EDA (Electron Donor Acceptor) complexes.

UNIT II: AROMATICITY AND REACTION MECHANISM 15 Hrs

Aromaticity in benzenoid and non–benzenoid compounds, alternant and non–alternant hydrocarbons, Huckel's rule, energy level of π-molecular orbitals, annulenes, anti aromaticity, Pseudoaromaticity, homo-aromaticity, PMO approach.Types of mechanisms, Types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Potential energy diagrams, transition states and intermediates, kinetic and non-kinetic methods of determining mechanisms, isotope effects. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes.

UNIT III: STEREOCHEMISTRY 15 Hrs

Optical activity, chirality, symmetry elements, asymmetry and disymmetry, Fischer's projections, absolute configurations, Cahn-Ingold-Prelog rules, enantiomers and diastereomers. Asymmetric synthesis, asymmetric catalyst and chiral auxiliaries, optical purity and enantiomeric excess, enantiotropic and diastereostropic atoms, groups and faces.

Stereoselectivity and stereospecificity, enantioselective and diastereoselective representative reactions. Role of enzymes, optical activity of biphenyl compounds, molecular overcrowding, stereo chemistry of allenes and spirans – Optical acitivity of compounds containing Nitrogen and Sulphur. E-Z nomenclature, use of spectroscopic methods in determining configurations of geometrical isomers. Stereoisomerism of cyclic compounds - three, four and five membered ring systems.

UNIT IV: CONFORMATIONAL ANALYSIS 15 Hrs

Configuration and conformation – definition, conformers and conformational isomers and atropisomers, conformational analysis of acyclic and cyclohexane systems, conformational free energy difference, determination by kinetic method by Eliel-Ro equation - stability and isomerism in mono and di substituted cyclohexanes, reactivity in cyclohexanes. Simple reactions illustrating torsional, steric and stereo electronic factors in acyclic and cyclohexane derivatives. Curtin-Hammett principle, conformation and reactivity of cyclohexenes and cyclohexanone. Conformational analysis of decalins.

UNIT V: NATURAL PRODUCTS 15 Hrs

A: CARBOHYDRATES: Configuration and conformation of aldohexopyranoses, structure and synthesis of disaccharides – maltose, lactose, sucrose – polysaccharides – starch and cellulose – Chemistry of amino sugars – methods of determining the size of the sugar rings – cyclodextrins.

B: TERPENES: Structural elucidation of α–santonine and Zingiberene.

C: ALKALOIDS: General methods of determining structure – structural elucidation and stereo Chemistry of quinine and morphine.

REFERENCES:

1. Jerry March, Advanced organic Chemistry – Reactions, Mechanism and structure ,John Wiley and sons pvt.ltd.IVth edition. 2007
2. P.S. Kalsi, StereoChemistry , conformation and mechanism, Wiley Eastern Ltd - IV th edition,2006.
3. D.Nasipuri, StereoChemistry of organic compounds, Principles and application ,Wiley Eastern Ltd, IInd edition. 2006.
4. I.L. Finar, Organic Chemistry Vol. II, ELBS Longman, V th edition in Chennai. 1975
5. O.P.Agarwal,chemistry of organic Natural products, Vol I,37 th edition GOEL publishing House, Meerut. 2008
6. O.P.Agarwal,chemistry of organic Natural products, Vol II,34 th edition GOEL publishing House, Meerut. 2008
7. Clayden, Greeves, Warren and Worthers, Organic Chemistry, OXFORD University Press, 2007.

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SEMESTER I
(For those who joined in June 2017 and after)

Part III- Core Subject Theory – II		
Subject Title **: Inorganic Chemistry - I**		
Subject Code: 33CT12	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To comprehend and apply the theory of chemical bonding*
- *To learn about the non aqueous solvents*
- *To understand the explore to concept co-ordination chemistry*
- *To understand the principles chemistry of non-transition elements*

UNIT I: THEORIES OF BONDING 15 Hrs

A: VALENCE BOND THEORY: Concept of hybridization - VSEPR theory and prediction of structures and shapes of molecules - Modern quantum mechanical description, electro- negativity - Mullikan-Jaffe definition, polar covalent bonds, resonance and hydrogen bonding.

B: MOLECULAR ORBITAL THEORY: Molecular orbital theory of diatomic molecules (Be_2, O_2^-, NO, CO,), multi center orbitals (NO_2^-)

C: IONIC BONDING: Close packing of atoms and ions – hcp, bcc packing - Radius ratio rules, lattice energy, Born-Lande equation, Kapustinkii equation, Born-Haber cycle, applications.

UNIT II: THEORIES OF ACIDS AND BASES 15 Hrs

A: HARD AND SOFT ACIDS AND BASES

Classification of hard and soft acids and bases, interpretation of hardness, chemical consequences of hardness, principle of soft and hard acids and bases (SHAB) – Theories – HSAB approach, applications of HSAB principle. The Usanovich concept.

B: NON AQUEOUS SOLVENTS

Classification of solvents. Study of the following non-aqueous solvents. Liquid NH_3, SO_2, N_2O_4, HF and acetic acid.

UNIT III: CHEMISTRY OF NON-TRANSITION ELEMENTS-I 15 Hrs

Synthesis, properties and structure of the boranes, carboranes, borazines, electron deficiency, Wade's rule and STYX number. Isopoly and heteropoly acids

– Structure and bonding of 6 and 12 isopoly – and heteropoly anions - Silicates-types of silicates-neso, soro, cyclic, chain, phyllo, feldspars, zeolites and Ultramarines- applications silicones. Carbides – Ionic, interstitial, covalent carbides. phosphazenes, sulphur-nitrogen compounds: Tetra sulphur tetra nitride, (S_4N_4), Disulphur dinitride (S_2N_2) and sulphur–nitrogen polymer $(SN)_n$.

UNIT IV: CO-ORDINATION CHEMISTRY-I 15 Hrs

Coordination Chemistry of transition metal ions: Nomenclature, isomerism, stereoisomerism, chirality and nomenclature of chiral coordination complexes, optical activity, optical rotatory dispersion (ORD), circular dichroism (CD), ligand conformation and geometrical isomerism.

UNIT V: CO-ORDINATION CHEMISTRY-II 15 Hrs

Stability constants of complexes and their determination - Job's continuous variation method – Chelate effect, Trans effect, Template effect – Theories of bonding: Valence bond theory (VBT), Crystal field theory (CFT), Ligand field theory (LFT) – CFSE – Evidence for CFSE - Molecular orbital theory (MOT) – splitting of d-orbitals in low symmetry environments: Jahn–Teller Effect.

REFERENCES

1. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John Wiley & Sons, New York, IV th edition. 1998
2. James E. Huheey, Inorganic Chemistry, Principles of structure and Reactivity, Dorling Kindersely (India) Pvt Ltd. - IV th Edition.2007
3. R.S. Drago, Physical methods in Inorganic Chemistry, Reinhold NY 1965.
4. R.S. Drago, Physical methods in Chemistry W.B.Saunders, Philadelphia 1977
5. K.F. Purcell and J..C. Kotz, Inorganic Chemistry, Saunders, Philadelphia 1977.
6. B.N. Figgis, Introduction to Ligand Fileds Interscience NY 1966.
7. J.D.Lee, Concise Inorganic Chemistry, ELBS, Chapman and Hall Londen , 2006 -V th edition.

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SEMESTER I
(For those who joined in June 2017 and after)

Part III - Core Subject Theory – III		
Subject Title **: Physical Chemistry - I**		
Subject Code: 33CT13	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To acquire knowledge about the gaseous state*
- *To learn about the concept of chemical thermodynamics*
- *To understand the explore to concept quantum chemistry*
- *To understand the principles of chemical kinetics*

UNIT I: GASEOUS AND LIQUID STATE 15 Hrs

Maxwell distribution of molecular velocities – derivation and experimental verification – types of velocities – energy distribution – Maxwell – Boltzmann distribution Law – Equipartition principle and heat capacity – Mean free path – molecular collisions – transport properties – thermal conductivity – viscosity and diffusion. Structure of liquids – X-ray method – internal pressure – Liquid crystals – theory and applications.

UNIT II: CHEMICAL THEROMODYNAMICS 15 Hrs

Thermodynamic equation of state – Derivation and their application to non-ideal gases – calculation of ($\Delta H/\partial P)_T$, $(\Delta E/\partial V)_T$ and $\mu_{JT.}$ Thermodynamics of system of variable composition -partial molal quantities – chemical potential – relationship between partial molal quantities – determination of partial molal quantities - Gibbs Duhem equation – Thermodynamic properties of real gases – Fugacity concept – Determination of fugacity of real gases – Activity concepts of condensed states – choice of standard states. Determination of activity and activity coefficients. Basic concepts of non - equilibrium thermodynamics. Onsager reciprocal relationships – microscopic reversibility (concept only – derivation not necessary).

UNIT III: QUANTUM MECHANICS – I 15 Hrs

Black body radiation – de Broglie's wave particle duality – Experimental verification of matter waves – Compton effect – Heisenberg's uncertainty principle – postulates of quantum mechanics – operators – linear and non -linear operators – Hermitian operators – momentum, kinetic energy – total energy – angular momentum – proving operators are Hermitian commutator algebra – Evaluation of

commutators – introducing Dirac notation – Eigen function – Eigen value and degeneracy — setting up of Schrodinger wave equation – interpretation of wave function – Orthogonal function – expansion theorem -Schmidt orthogonalisation.

UNIT IV: QUANTUM MECHANICS – II 15 Hrs

Application of SWE to free particle moving in one dimension – particle moving in a one dimension box with zero potential energy inside and infinite potential outside. Particle moving in 3D cubical and rectangular box. Quantum mechanical Tunnelling and transmission coefficient – particle in a ring – Simple harmonic oscillator – 3D uncoupled Isotropic harmonic oscillator – rigid rotator - hydrogen atom – radial distribution functions – spherical harmonics – shapes of various orbitals (1s, 2s, 2p) – angular momentum, spin momentum.

UNIT V: CHEMICAL KINETICS 15 Hrs

Simple collision theory, potential energy surfaces, absolute reaction rate theory, thermodynamic treatment, comparison of ARRT and collision theories. Application of ARRT to simple bimolecular process - steady state approximation. Theory of unimolecular reactions – Lindemann, Hinshelwood, RRKM and Slater treatments. Reactions in solutions – factors influencing reaction rate in solution – significance of activation, salt effect, and kinetic isotope effect.

REFERENCES:

1. G.W. Castellan, Physical Chemistry, Addision – Wiesley publishing company, IIIrd edition.1986
2. S. Glasstone, A text book of physical Chemistry, Macmillan India Ltd., 1999.
3. W.J. Moore, Physical Chemistry, Orient Longmann ,1982.
4. S. Glasstone – Thermodynamics for chemists.East – West Press Pvt Ltd., New Delhi, XIth edition.2000
5. A.K. Chandra. Introductory Quantum Chemistry IIIrdedition, Tata McGraw Hill publishing Co, New Delhi 1988.
6. H.W. Hanna, Quantum Mechanics in Chemistry, Benjamin – Cummiza London publishing company, 1983.
7. D.A. Mc Quarrie, Quantum Mechanics, Oxford university press, 1983.
8. P.W. Alkins, Molecular Quantum Mechanics, Oxford University press, second edition 1986.
9. K.J. Laidler, Chemical kinetics, third edition, Harper and Row publishers. 2001

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SEMESTER I
(For those who joined in June 2017 and after)

Part III - Core Paper Practical – I		
Subject Title **: Organic Qualitative Analysis**		
Subject Code: 33CP14	Hours per week: **5**	Credit: **3**
Sessional Marks: **40**	Summative Marks: **60**	Total Marks: **100**

Objectives:

To enable the students

- *To estimate the organic compounds quantitatively.*
- *To separate the components in a organic mixture and to analyse them.*

Separation and analysis of two component mixtures.

Identification of the components and preparation of solid derivatives.

REFERENCES:

1. A.I.Vogel, Elementary Practical Organic chemistry, Part III- Quantitative Organic analysis Longmann London,IV thEditon. 1987.

SEMESTER I
(For those who joined in June 2017 and after)

Part III - Core Paper Practical – II		
Subject Title **: Inorganic Qualitative Analysis**		
Subject Code:33CP15	Hours per week: **5**	Credit: **3**
Sessional Marks: **40**	Summative Marks: **60**	Total Marks: **100**

Objectives:

To enable the students

- *To develop skill in semimicro qualitative analysis.*

Semi- micro qualitative analysis:

Analysis of mixture containing two familiar and two less familiar cations from the following:

W, Pb, Tl, Se, Te,Mo,Cu, Bi, Cd, Ce, Th, Zr, Ti, V, Cr, Mn, Al, U, Ni, Co, Ba, Sr, Li,and Mg.

(Insoluble and interfering anions may be avoided)

REFERENCES :

1. Dr.V.V.Ramanujam, Inorganic semi – micro qualitative analysis, the National Puplishing Company, III Edition.2008
2. A.I.Vogel, Elementary Practical Organic chemistry, Part III- Quantitative Organic analysis – Longmann London,IV thEditon. 1987

M.Sc. Chemistry CBCS Syllabus

SEMESTER I
(For those who joined in June 2017 and after)

Elective Paper – I		
Subject Title **: Computer Applications in Chemistry**		
Subject Code: 33EP1A	Hours per week: **5**	Credit: **5**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To acquire knowledge about the basic concepts of programming in C*
- *To learn about the concept of communication systems*

UNIT I 15 Hrs

Basic concepts of Programming in C

Introduction to computers - Character set – keywords and identifiers – constants, variables, data types – declaration of variables – assigning values to variables – Defining symbolic constants.

Operators

Arithmetic operators – relational operator, logical operators, assignment operators, increment and decrement operators, conditional operators, bitwise operators and special operators – Arithmetic expression – evaluation of expression, precedence of arithmetic operators – computational problems. Managing input and output operators: Reading a character – writing a character – format input – formatted output.

UNIT II 15 Hrs

A: Array

Introduction – one-dimensional array and two-dimensional array – initialize an arrays.

B: Functions

Introduction – different types of functions – nesting of functions – regression – library function.

C: Pointers

Introduction – accessing the address of a variable – declaring and initializing pointers – accessing a variable through its pointers – pointers and array – pointers and functions.

Applications in Chemistry

Few selected problems – determination of molarity, molality and normality of solutions, calculation of pH, calculation of cell parameters, calculation of concentration of Beer-Lamberts law – Determination of rate constants in kinetics.

UNIT III 15 Hrs

Basic concept of communication systems

Communication system: satellites-RADAR- optical fibers- advantage and disadvantages-ISDN-distributed systems-advantages and disadvantage.

Telecommunications: Analog digital signals-types and needs of modulation-MODEMS-telecommunication software.

Computer networks: an overview-communication processors-protocols-network architecture.

UNIT IV 15 Hrs

Salient features of windows and MS word for typing texts and equation in Chemistry- tabular columns-advanced concepts.

Basic concept of creating and accessing databases using MS access.
Significance of chem draw- drawing chemical structure and pasting them in the text.

UNIT V 15 Hrs

Basic concept of internet and applications in Chemistry

Internet: History of the internet- the working way of internet-getting connected to internet-internet protocols-internet addressing-domain names-

WWW: Web page-home page- web browsers- search engine- internet chat-chatting on web.

E-Mail: Introduction –working way-mailing basic- e-mail ethics-advantages and disadvantages-creating e-mail- receiving and sending e-mails.
Internet: characterdsation advantages- drawbacks-need for intranet- extranet.

Application of internet in Chemistry:
Web site in literature survey in Chemistry-popular websites in Chemistry-data base in Chemistry URLS-WAIS- downloading the attachment/ PDF files- opening browsing and searching a website- literature searching online.

REFERENCE BOOKS

1. Programme in C by E.Balagurusamy Tata Mcgraw-Hill Publishing Company, New Delhi 2nd edition.
2. Barbara Kasser, “Using the Internet”, Fourth Edition, EE Edition, New Delhi, 1998.

3. K.V.Raman, "Computers in Chemistry", Tata-McGraw Hill Publishing Company, New Delhi, 1993.
4. Alexis Leon and Mathews Leon, "Fundamentals of Information Technology", (chapters 17 – 19 & 21 – 23), Leon Vikas, Chennai (1998)

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SEMESTER I
(For those who joined in June 2017 and after)

Elective Paper – I		
Subject Title **: Environmental Science**		
Subject Code: **33EP1B**	Hours per week: **5**	Credit: **3**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

UNIT I: Introduction (15 Hrs)

Introduction – Environmental science- Environmental Chemistry-Ecology-definition Eco-system- Cycling of mineral elements and gases-phosphate cycle- carbon cycle-Hydrogen cycle- Nitrogen cycle-hydrological cycle-Environmental segments-Pollution and its types: air pollution- water pollution- soil pollution- radioactive pollution thermal pollution- noise pollution marine pollution other types of pollution and its effects and control- remedial measure.

UNIT: II Air Pollution (15 Hrs)

Introduction- source of air pollution –air pollutants classification and effects of air pollutants- oxides of nitrogen, sulphur and carbon- acid rain –effects and control-hydrogen sulphide-effects and control-carbon mono oxide- effects and control-photochemical smog- effects and control- fly ash-effects and control- green house effect-global warming effect and control ozone layer- ozone depletion-chloro fluoro carbons-effects and control

UNIT III: Water pollution (15 Hrs)

Introduction- types of water- water pollution –sources of water pollution- water pollutants- classification- physical, chemical and biological- inorganic pollutants and toxic metals-organic pollutants- radioactive pollutants in water pesticide and fertilizers-suspended particles- water quality index-ill effects of water pollutants- fluorosis-water pollution control-water treatment- primary, secondary and tertiary treatment- desalination reverse osmosis-sewage and industrial waste water treatment.

UNIT IV: Soil Pollution (15 Hrs)

Introduction – types of soil -soil pollution-types-indicator of soil pollution- plants as indicator of pollution- source of soil pollution-fertilizer and pesticides-radioactive pollutants-solid waste-oil sediments as pollutant-soil erosion-treatment of soil protection-remedial measures for soil pollution.

UNIT V: Analysis of Pollutants (15 Hrs)

Introduction- analysis of air pollutants- units-sampling-devices and methods for sampling-measurement: UV-visible spectroscopy-IR spectroscopy-emission spectroscopy –turbidimetry nephelometry- gas chromatography –HPLC- chemiluminescence of nitrogen oxides –IR photometry – conductometry- analysis water pollutants – units – sampling – devices and methods for sampling – measurements : UV-visible spectroscopy-titration –analysis of different water quality parameters- BOD- COD- analysis and monitoring of pesticides, carcinogens, and industrial pollutants.

Reference books

1. B.K. Sharma and H.Kaur, Environmental Chemistry, Krishna Prakashan,meerut,1997
2. A.K.De, Environmental Chemistry, Wiley eastern Ltd., Meerut, 1994.
3. A.K Mukaherjee, Environmental Pollution and Health Hazards- Causes and Control, Galgotia Prees, New Delhi, 1986.
4. N.Manivasakam, Physico-chemical Examination of Water, Sewage and Industrial Effluents, Pragati Prakashan Publ., Meerut, 1985

M.Sc. Chemistry CBCS Syllabus

SEMESTER II
(For those who joined in June 2017 and after)

Part III - Core Subject Theory – IV		
Subject Title **: Organic Chemistry - II**		
Subject Code: 33CT21	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To know about the nucleophilic, electrophilic Substitutions, eliminations and addition reactions*
- *To study about the reaction mechanism and reagents*

UNIT I: NUCLEOPHILIC SUBSTITUTIONS 15Hrs

The S_N1, S_N2, S_Ni reaction mechanisms - Reactivity effects of substrate - attacking nucleophile, leaving group and reaction medium - the neighbouring group participation involving non-bonded electrons, π and σ electrons - classical and non-classical carbocations, phenonium ions, norbornyl system. Ambident nucleophile – ambident substrate.

Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon. Nucleophilic substitution in aromatic system – mechanism - benzyne and $S_{RN}1$ mechanisms.

UNIT II: ELECTROPHILIC SUBSTITUTIONS AND ELIMINARIONS 15Hrs

Bimolecular mechanisms - S_E2 and S_Ei. The S_E1 mechanism, electrophilic substitution accompanied by double bond shift. Effect of substrates, leaving group and the solvent polarity on the reactivity.The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling. Vilsmeir reaction, Gattermann–Koch reaction.

The E2, E1 and E1cB mechanisms - effects of substrate structures, attacking base, the leaving group and the medium. Orientation of the double bond. Hoffmann and Saytzeff rule. Substitution Vs Elimination ratio (e/n ratio). Mechanism and

orientation in pyrolytic elimination. Bredt's rule–Mechanism of acid and base catalysed estrification and hydrolysis.

UNIT III: ADDITIONS TO C=C AND C=O GROUPS . 15Hrs

Electrophilic and nucleophilic addition – stereochemistry – addition to conjugated systems – addition to carbon – carbon double bond in alpha, beta – unsaturated carbonyl and nitrile systems – Michael addition – addition of Grignard reagents – Diels-Alder reactions – Enamine reaction.

Reformatsky reaction – Darzen reaction, Mannich reation-Wittig reaction – Addition to cyclopropane ring, hydroboration and sharpless asymmetric epoxidation.

UNIT IV: NAME REACTIONS AND THEIR MECHANISM 15Hrs

Ene reaction – Hoffmann-Loffer-Fraytag reaction – Shapiro reaction – Bayer-Villiger reaction – Chichibabin reaction – Skraup synthesis – Fischer indole synthesis – Robinson annulation – Oppennaur oxidation – Clemmenson, Wolf-Kishner, Meerwein-Ponndorf –Verley and Birch reduction. Mechanism of Stobbe and Dieckman condensation.

UNIT V: REAGENTS IN ORGANIC SYNTHESIS 15Hrs

Complex metal hydrides such as $LiAlH_4$, $NaBH_4$, $Na(CN)BH_3$, $Zn(BH_4)_2$. Gilman's reagent, Lithiumdimethylcuprate, Lithium disopropylamide (LDA), Dicyclohexylcarbodimide 1,3 – Dithiane (reactivity umpolung), Trimethylsilyl iodide, Tri-n-butyltin hydride, Woodward and Prevost hydroxylation, osmium tetroxide, DDQ, Selenium dioxide, phase transfer catalysts, Crown ethers and Merrifield resin, Peterson's synthesis, Wilkinson's catalyst, Baker yeast.

REFERENCES:

1. Jerry March, Advanced organic Chemistry – Reactions, Mechanism and structure ,John Wiley and sons pvt.ltd., - IVth edition. 2007
2. Clayden, Greeves, Warren and Worthers, Organic Chemistry, OXFORD University Press, 2007.
3. Carey and Sundberg, Advanced Organic Chemistry Part – A Structure and mechanism ,Part – B
4. Reaction and synthesis ,Plenum press, IIIrd Edition 1990.
5. Graham Solomons, organic chemistry, John Wiley and Sons INC Vth Eddition 1963.
6. Michael B. Smith, Organic synthesis,M.C. Graw Hill, International Edition, 1994.
7. Norman and J.M.Coxon, Principles of organic synthesis,ELBS,III rd Edition, 1993.

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SEMESTER II
(For those who joined in June 2017 and after)

Part III - Core Subject Theory – V		
Subject Title **: Inorganic Chemistry II**		
Subject Code: 33CT22	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To have an idea about various electronic spectra of inorganic complexes*
- *To have an sight in to organometallic chemistry*
- *To know about the essential of nuclear chemistry*

UNIT I: ELECTRONIC SPECTRA OF INORGANIC COMPLEXES 15 Hrs

Electronic spectra – Spin forbidden transitions the effects of spin-orbit coupling, Band contours, Band intensities, shapes of peaks.

Term symbols, Orgel and Tanabe-Sugano Diagrams – Racah parameters – T.S diagram of d^6 configuration – nephelauxetic ratio and series – Calculation of 10Dq and assignment of transitions to the spectrum of $3d^1$ to $3d^9$ (Cobalt and Nickel Complex). Charge transfer spectra.

UNIT II: MAGNETISM & REACTION MECHANISM OF INORGANIC COMPLEXS 15 Hrs

Magnetism: Classical Magnetism, Orbital contribution to a magnetic moment Spin only formula magnetically non-diluted compound. Dia, para, ferromagnetism and antiferromagnetism.

Inorganic reaction mechanisms: Substitution reactions in octahedral and square planar complexes Trans effect and electron transfer reactions – outer sphere and inner sphere electron transfer reactions - Marcus theory.

UNIT III: ORGANOMETALLIC CHEMISTRY OF TRANSITION ELEMENTS 15 Hrs

Sixteen and eighteen electron rule, metal carbonyls, metal carbene and metal carbyne complexes: acetylene, cyclopenta dienyls, cyclopenta dienide and benzenoid systems.

Metallocenes: synthesis, structure, bonding and reactivity. Coordinative unsaturation and insertion reactions - oxidative addition and reductive elimination reactions - rearrangement – ligand protonation – fluxional isomerism – activation of small molecules by complexation.

CATALYSIS BY ORGANOMETALLIC COMPOUNDS

Wilkinson's catalyst – Tolman catalytic loops – Hydroformylation – Wacker process – synthetic gasolines.

UNIT IV: METAL π–COMPLEXES 15 Hrs

Metal carbonyls: Structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls. Preparation, bonding, structure and important reactions of metal nitrosyl, dinitrogen and dioxygen complexes.

UNIT V: NUCLEAR AND RADIOCHEMISTRY: 15 Hrs

RADIOACTIVE EQUILIBRIA

GM counter, Scintillation counter, Si solid state counter. Nuclear shell model – liquid drop model – Q value. Artificial radioactivity. Linear accelerator and synchro cyclotron – Nuclear fission and fusion reactions - Stellar energy – Nuclear reactors – breeder reactor -activation analysis (specify) – isotope dilution technique – radiometric titration.

REFERENCES

1. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry,VI Edition John Wiley & Sons, New York. 2004.
2. James E. Huheey, Inorganic Chemistry, Principles of structure and Reactivity, Dorling Kindersely (India) Pvt Ltd - IV th Edition. 2007.
3. R.S. Drago, Physical methods in Inorganic Chemistry, Reinhold NY 1965.
4. R.S. Drago, Physical methods in Chemistry W.B.Saunders, Philadelphia 1977
5. K.F. Purcell and J..C. Kotz, Inorganic Chemistry, Saunders, Philadelphia 1977.
6. B.N. Figgis, Introduction to Ligand Fileds Interscience NY 1966.J.D.Lee, Concise Inorganic Chemistry, ELBS, Chapman and Hall Londen , 2006 -V th edition.
7. Powell, P., Principles of Organometallic Chemistry IInd Edition Chapman and Hall, NewYork,1988.
8. Fredlander and J.W. Kennedy E.S. Macias, J.M. Miller, Nuclear and RadioChemistry, IIIrd Ed, John Niky and Sons, 1981.

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SEMESTER II
(For those who joined in June 2017 and after)

Part III - Core Subject Theory		
Subject Title **: Physical Chemistry - II**		
Subject Code: 33CT23	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives

To enable the students

- *To understand the application of quantum mechanics*
- *To get an insight into the principles of molecular spectroscopy*
- *To have an idea about chemical kinetics*
- *To study about the photochemistry*

UNIT I: QUANTUM MECHANICS – III 15 Hrs

The variation method and perturbation theory: Application to the helium atom,Slatter orbital, Self Consistent Field (SCF) method - antisymmetry and exclusion principle, Slater determinatal wave functions. Term symbols and spectroscopic states of atoms and diatomic molecules.

Born–Oppenheimer approximation: Hydrogen molecule ion. LCAO – MO and VB treatments of the hydrogen molecule - electron density, forces and their role in chemical binding. Hybridization and valence MOs of H_2O, NH_3 and CH_4 . Huckel pi-electron theory and its application to ethylene, butadiene and benzene.

UNIT II: SPECTROSCOPY-I 15 Hrs

A: MICROWAVE SPECTROSCOPY

Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor, Stark effect- applications.

B: INFRARED SPECTROSCOPY

Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strength – anharmonicity, Morse potential energy diagram, vibration–rotation spectroscopy, P, Q, R branches, Fortrat diagrams - Breakdown of Born-Oppenheimer approximation-vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands.

UNIT III: SPECTROSCOPY-II 15 Hrs

RAMAN SPECTROSCOPY

Classical and quantum theories of Raman Effect. Pure rotational, vibrational and vibrational-rotational Raman Spectra, selection rules, mutual exclusion principle. Resonance Raman spectroscopy –introduction and application to [W $(CO)_4$(phen)]

i) MOLECULAR SPECTROSCOPY

Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Frank-Condon principle,dissociation energy of diatomic molecules - electronic spectra of polyatomic molecules.

ii) PHOTOELECTRON SPECTORSCOPY

Basic principles – Photo electric effect, ionization process, Koopman's theorem. Photo electron spectra of simple molecules, ESCA, Chemical information from ESCA.. Aguer effect – basic idea.

iii) PHOTO ACOUSTIC SPECTROSCOPY

Basic principles of photo acoustic spectroscopy (PAS), PAS–gases and condensed systems, chemical and surface applications.

UNIT IV: CATALYSIS AND SURFACE CHEMISTRY 15 Hrs

Homogeneous catalysis – acid-base catalysis, acidity function – Michaelis-Menton kinetics, fast reaction techniques, chemical relaxation methods, T-jump and p-jump methods, ultrasonic absorption techniques, reaction in a flow system, continuous and stopped flow methods.

Physisorption and chemisorption – Langmuir, BET and Gibbs adsorption isotherm – insoluble surface films – electro kinetic phenomena – zeta potential – Heterogeneous catalysis – unimolecular and bimolecular reactions and their kinetics - micellar Chemistry (Introduction and basic aspects).

UNIT V: PHOTOCHEMISTRY 15 Hrs

Photophysical response from electronically excited molecules, radiative and radiationless transitions, internal conversion and intersystem crossing, fluorescence, phosphorescence,Jablonski diagram, and delayed fluorescence,life time of excited molecules,quenching proess, Stern-Volmer equation- principles of energy transfer-spin –orbit coupling, eximers and exciplexes.

Properties of excited states-excited state acidity constant. Kasha's tests for identification of $n \rightarrow \pi*$ and $\pi \rightarrow \pi*$ transitions.Applications of photoChemistry - photosynthesis, solar energy conversions and storage- photochemical fast reactions-Flash photolysis technique.

.REFERENCES

1. A.K. Chandra, Introductory quantum Chemistry – Fourth edition – Tata McGraw Hill publishing Co.Ltd. New Delhi. - 1996
2. B.K. Sen, Quantum Chemistry, Tata McGraw Hill Co. Ltd., New Delhi. 1992
3. Samuel H. Maron and Carl M. Prutton, Principle of physical Chemistry, Fourth edition, Oxford and IBH Pub. Pvt. Ltd. New Delhi. 1976
4. R.K. Prasad, Quantum Chemistry, Wiley Eastern. Third edition- 2000
5. W. Atkins, Physical Chemistry,7th Oxford University Press- 2000
6. F.A. Cotton, Chemical application of group theory, 2nd edn, Wiley Eastern Ltd.- 1997
7. K.K. Rohatgi–Mukheriji, Fundamentals of PhotoChemistry, Wiley-Eastern.- 2000
8. Cox and T. Camp, Introductory photoChemistry, McGraw-Hill publishing Co.Ltd. New Delhi. - 1996
9. Colin N.Banwell Fundamentls Of Molecular Spectroscopy ,Tata Mc Graw Hill Comp. Ltd., New Delhi-1997
10. R.S. Drago, Physical methods in Chemistry, Sainders college. 1987

11. G.M. Barrow, Introduction to molecular spectroscopy, MC Graw Hill publishing Co.Ltd. New Delhi.- 1994
12. R. Chang, Basic Principles of spectroscopy, Mc Graw Hill publishing Co.Ltd. New Delhi.-1992

M.Sc. Chemistry CBCS Syllabus

SEMESTER II

(For those who joined in June 2017 and after)

Part III – Core subject Practical		
Subject Title **: Organic Quantitative Estimation**		
Subject Code: 33CP24	Hours per week: **5**	Credit: **3**
Sessional Marks: **40**	Summative Marks: **60**	Total Marks: **100**

Objectives:

To enable the students

- *To estimate the organic compounds quantitatively.*

1. Quantitative Estimation:

a. Estimation of glucose by Lane and Eynon method and Bertrand method
b. Estimation of glycine
c. Estimation of formalin.
d. Estimation of methyl ketone

Organic preparation:

About 5(five)- two- stage preparation:

a. p- nitro aniline from acetanilide
b. p- bromoaniline from acetanilide
c. m-nitro benzoic acid from methyl benzoate
d. benzanilide from benzophenone
e. sym-tribromo benzene from aniline.

REFERENCE:

1. A.I.Vogel, Elementary Practical Organic chemistry, Part III- Quantitative Organic Analysis Longmann London,IV thEditon. 1987.

M.Sc. Chemistry CBCS Syllabus SEMESTER II

(For those who joined in June 2017 and after)

Part III - Core subject Practical		
Subject Title **: Physical Chemistry practical**		
Subject Code: 33CP25	Hours per week: **5**	Credit: **3**
Sessional Marks: **40**	Summative Marks: **60**	Total Marks: **100**

Objectives:

To enable the students

- *To develop knowledge about quantitative estimation.*
- *Get training in using Conductometric Bridge and potentiometer.*
- *To get an idea about adsoption.*
- *To know the application of UV –Visible spectrophotometer.*

1. **Polarimetry**: Inversion of cane sugar – Relative strengths of two acids.
2. **ThermoChemistry**: Enthalpy of solution by solubility method – unknown concentration.
3. **Rast Micro Method**: Determination of K_f and molecular weight by micro method.
4. **Adsorption**: Adsorption of acetic acid/oxalic acid on activated charcoal. Freundlich adsorption isotherm – determination of unknown concentration.

COUNDUCTIVITY EXPERIMENTS

1. Determination of cell constant
2. Determination of λ_a for acetic acid using Kholrausch's law.
3. Saponification of ester followed by counductometric method
4. Solubility products of sparingly soluble salts.

POTENTIOMETRIC EXPERIMENTS

1. Measurnment of standard electrode potential
2. Determination of pH using quinhydrone electrode
3. Potentiometeric redox titration (KI Vs $KMnO_4$ Vs KI)

REFERENCE:

1. A.O. Thomas and Mani Text Book of Practical Chemistry Scientific Publication, IVth Revised Edition, 1976.

M.Sc. Chemistry CBCS Syllabus

SEMESTER II
(For those who joined in June 2017 and after)

Elective Paper – II		
Subject Title **: Medicinal and Pharmaceutical Chemistry**		
Subject Code: 33EP2A	Hours per week: **5**	Credit: **5**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To know the medicinal values of various drugs, its actions and Metabolism of drugs.*
- *To gain basic knowledge about common diseases.*
- *To know about the chemotherapy*

UNITI: INTRODUCTION 15 Hrs

Common diseases-infective disease- Insect-borne,air- borne and water borne- hereditary disease terminology-drug, pharmacology, pharmacognesy, pharmacodynamics, pharmacokinetics, antimetabolites absorption of drugs- routes of administration of drugs, factors affecting absorption - Assay of drugs -chemical, biological, immunological assays, LD_{50} and ED_{50} therapeutic index, drug dosage. Drug analysis and Design of Drugs

UNIT II: DRUGS AND THEIR FUNCTIONS 15 Hrs

Various source of drugs, pharmacologically active constituents in plants, Indian medicinal plants- tulsi, neem, keezhanelli- their importance –Classification of drugs- biological chemical- Mechanism of drug action- Action at cellular and extra cellular sites. Drug receptor and biological responses- Metabolism of drug through oxidation, reduction, hydrolysis and conjugate processes factors affecting metabolism.

UNIT III: CHEMOTHERAPY 15 Hrs

Designation of drug based on physiological action; Definition and two examples each of Anaesthetic- General, and local-Analgesics- Narcotic and synthetic-Antipyretics and anti inflammatory agents-Antibiotics- penicillin, streptomycin, chloraphenicol, tetracyclins-Antivirals, AIDS-symptoms, prevention, treatmeant – Cancer and neoplastic agents.

UNIT IV: COMMON BODY AILMENTS 15 Hrs

Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure – sistolie & Diastolic Hypertensive drugs – Cardiovascular drugs – antiarrhythmic, antianginals, vasodilators –CNS depresents and stimulants –Psychedelic drugs,

hypnotics, sedatives (barbiturates, LSD) – Lipid profile – HDL, LDL cholesterol, lipid lowering drugs.

UNIT V: HEALTH PROMOTING DRUGS 15 Hrs

Nutraceuticals – Vitamins A B C D E and K, micronutrients Na, K, Ca, Cu, Zn, I - Medicially important inorganic compounds of Al, P, As, Hg, Fe – examples for each their role and applications – Organic Pharmaceutical acids; Agents for kidney function(Aminohippuric acid); Agents for liver function (Sulfo bromophthalein); Agents for pituitary function (metyrapone) – Organic pharmaceutical bases – antioxidants, treatement of ulcer and skin diseases.

TEXT BOOK

1. Pharmaceutical Chemistry, Jayashree Ghosh, S.Chand and Company Ltd., New Delhi.2006,

REFERENCE

1. Pharmaceutical Chemistry Lakshmi S., , S.Chand & Sons, New Delhi , 1995
2. Medicinal Chemistry Ashutosh kar, , Wiley Eastern Ltd., New Delhi. 1993
3. Principles of Medicinal Chemistry, David William & Thomas Lemke, Foyes, Bl publisher. 5th edition 2005

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SEMESTER II
(For those who joined in June 2017 and after)

Elective Paper – II		
Subject Title **: Biochemistry**		
Subject Code: 33EP2B	Hours per week: **5**	Credit: **5**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

UNIT I: Enzymes and Co-enzyme (15hrs)

Classification, nomenclature, properties of enzymes, some features of active sites of enzymes, enzyme kinetics – Michaelis –Menton model – significance of K_M and V_{Max} values. Enzyme inhibition – competitive and non-competitive. Allosteric interaction – Mechanism of enzyme action. Lysozyme and carboxypeptidase. NAD, NADH, $NADH^+$

UNIT II: Generation and Storage of Metabolic energy (15hrs)

Metabolism – basic concepts and design : glycolyses – citric acid cycle – Oxidative phosphorylation – pentose pathway and gluconeogenesis. Glycogen and disaccharide metabolism, fatty acid metabolism – amino acid degradation and urea cycle – photosynthesis.

UNIT III: Information, Storage, transmission, expression of genetic information (15hrs)

DNA- Genetic role structure and replication; messenger RNA and transcription genetic code and gene protein relationship – protein synthesis, control of gene expression –Eucaryotic chromosomes. Recombinant DNA technology and viruses.

UNIT IV: Bio-inorganic Chemistry (15hrs)

Metalloproteins and enzymes – Blue copper proteins – copper proteins as oxidases/reductases – Nickel containing enzymes – structure of DNA – types of nucleic acid interactions – co-ordination, intercalation and hydrogen bonding – interactions of metal ions with nucleic acid – redox chemistry, hydrolytic cemistry – monitoring the DNA binding by UV, IR, NMR and CV spectral techniques.

UNIT V: Biophysical aspects (15hrs)

Electron transport and oxidative phosphorylation – Thermodynamic and kinetic aspects – Photosynthesis – An overview – Photosystem II – The light harvesting chlorophyII – protein complexes of photosystem II – Role of carotenoids in photosynthesis – The primary electron donor of photosystem II, P680 – The stable primary electron acceptor Q_A and the secondary electron acceptor Q_B – The transient intermediate electron acceptor of photosystem II,

pheophytin – Oxygen evolution – The role of manganese – The electron donor to $P680^+$ - Charge recombination in photosystem II – photosystem I – Light – harvesting chlorophyll - II – protein complexes of photosystem I – The primary electron donor of photosystem I, P700 – The primary electron acceptor A_o of photosystem I – The intermediate electron acceptor A_1 of photosystem I – Mobile electron carriers plastocyanin and ferredoxin and $NADP^+$ - reductase.

Suggested Readings:

Unit I-III

1. B.D.Hames and N.M.Hooper, BioChemistry, Viva Books Pvt. Ltd., 2003
2. J.M.Berg, J.L.Tymoczko and L.Stryer, BioChemistry, 5th Edn. W.H.Freman and company, New York, 2002.
3. A.L.Lehninger, BioChemistry, Nath Publishers.

Unit – IV

1. I.Bertini, H.B.Gray, S.F.Leppard and J.S.Valentine, Bioinorganic Chemistry, Viva Books Pvt. Ltd., 1998.
2. G.R.Chatwal and A.K.Bhagi, Bioinorganic Chemistry, Himalaya publishing House.

Unit – V

1. B.Ke, Advances in Photosysthesis, Vol.10 Photosynthesis – PhotobioChemistry and photobiophysics, kluwer Academic Publishers, Dordrecht, 2001.

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SEMESTER III
(For those who joined in June 2017 and after)

Part III - Core Subject Theory		
Subject Title **: Organic Chemistry - III**		
Subject Code: 33CT31	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To have an idea about spectroscopy*
- *To study about the photochemical reaction*
- *To know about the pericyclic reaction*
- *To know about synthetic principles.*

UNIT I: UV SPECTROSCOPYAND IR SPECTROSCOPY 15 Hrs

Colour and light absorption – calculation of λ_{max} for dienes and dienones (Woodward – Hofmann rules). Effect of reaction medium and p^H on the absorption maxima of molecules. Streochemical factors in electronic spectroscopy – UV – Vis –spectra of aromatic and heterocyclic compounds.

IR SPECTROSCOPY

Molecular vibrations – sample handling techniques – finger print region – Identification of functional groups and interpretation of IR spectra – Factors (hydrogen bonding, electronic effects, mass effects, conjugation and ring strain) influencing vibrational frequencies. Simple problems involving UV and IR data.

UNIT II: NMR SPECTROCOPY 15 Hrs

NMR phenomenon – CW and FT NMR – relaxation effects – chemical shift – factor influencing chemical shift (electronegativity, anisotropic effect, hydrogen bonding and van der waal's deshilding) – chemical and magnetic equivalence – exchange – phenomenon – spin-spin coupling – factors influencing coupling constants (Karplus equation) – Non First order spectra - simplification of complex spectra using double resonance techniques, shift reagents and increased field strength – Introduction to NOE – dynamic NMR – ^{13}C NMR - basic principles – off resonance and broad band decoupling techniques – γ-gauche effect- 2D NMR– problems solving based on UV, IR, NMR and mass data for simple molecules.

UNIT III: SYNTHETIC METHODS 15 Hrs

Importance of organic synthesis – requirements of an ideal synthesis - classification of organic reactions – principal carbon-carbon bond forming reactions – reaction involving functional group modifications. Planning synthesis – retrosynthetic analysis – concepts of synthon and synthetic equivalent donor synthon, acceptor synthon and neutral synthon – Molecular History – Key intermediates – starting materials in planning synthesis. Linear and convergent approach to synthesis grading of functional groups - Use of activating and blocking

groups in synthesis – stereoselectivity. Stereochemical problem involving in designing in synthesis.

UNIT IV: PERICYCLIC REACTIONS & PHOTOCHEMISTRY 15 Hrs

Application of symmetry to orbital interactions - selection rules (Woodward and Hoffmann rules) – electrocyclic, cycloaddition and sigmatropic reactions – Cope rearrangements, cheletropic reactions – Genaralised Woodward–Hofmann selection rules – Explanation of these reactions in terms of correlation diagram approach, FMO approach and Dewar–Zimmermann approach – (PMO) Huckel–Mobius concepts.

Photochemistry of olefines – cis-trans isomerisation – photochemical reactions of ketones – Norrish type I and type II reactions – Paterno – Buchi reaction – Dienone photochemistry – photoreduction, photochemical oxidation. Barton reaction – photochemistry of alkenes and dienes. Addition and isomerisation of alkenes – Di-pi methane rearrangements – photochemical rearrangements – photochemistry of aromatics.

UNIT V: ORD, CD AND MASS SPECTROMETRY 15 Hrs

Theories of ORD and CD – plane curves, Cotton effect curves – α-haloketone effect – octant rule – applications of α-haloketone rule and octant rule in determining the structure, configurations and conformations – comparision of ORD and CD.

An introduction to Mass spectrometry – parent peaks – base peaks – isotopic peaks –metastable peaks – fragment ions – fragmentation pattern of simple organic molecules. McLafferty rearrangement– simple problems related with organic molecules.

REFERENCES

1. R.M. Silverstein, G.C. Bassler and T.C. Morrill, Spectrometric Identification of Organic Compounds John wiley 1986
2. R.J. Abraham, J. Fisher and P. Loftus, Introduction to NMR Spectroscopy Wiley. V th Edition - 1996
3. William Kemp, Organic Spectroscopy, McMillan, 1986.
4. Norman and J.M.Coxon, Principles of organic synthesis,ELBS,III rd Edition, 1993.
5. C.H. Depuy and D.L. Chapman, Molecular Reaction and Photochemistry, Prentice Hall.- 1976
6. A.L. Bellamy, An Introduction to Conservation of Orbital Symmetry, Longman group Ltd., 1974
7. M.Mukheriji and S.P. Singh, Reaction mechanism in organic chemistry, Macmillan India Ltd, III Edition, 1998.
8. M.G.Arora, organic Photochemistry and Pericyclic reactions Anmol publications Pvt Ltd., New Delhi, I Edition, 2004.

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SEMESTER III
(For those who joined in June 2017 and after)

Part III - Core Subject Theory		
Subject Title **: Inorganic Chemistry - III**		
Subject Code: 33CT32	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives

To enable the students

- *To have an in depth study of bio-inorganic chemistry.*
- *To have an sight in to solid state chemistry*
- *To know about the spectral applications for the structural elucidation of Inorganic compounds.*
- *To have an idea about of lanthanides and actinides*

UNIT I : BIOINORGANIC CHEMISTRY – I 15 Hrs

Elements of living system: The biological roles of metal ions, calcium biochemistry, oxygen transport and storage – Haemoglobin and myoglobin, Cobalt containing models of O_2 carriers, cooperativity. Enzymes exploiting acid catalysis: Carbonic anhydrase, carboxypeptidases.

UNIT II : BIOINORGANIC CHEMISTRY – II 15 Hrs

Redox catalysis: Iron–sulphur proteins and non–heme iron, cytochromes of the electron – transport chain – outersphere character, distance dependence and tunneling, energy dependence and Marcus theory – cytochrome P–450 enzymes – structure of the active site, oxygenation mechanism. Vitamin B_{12}Coenzyme B_{12}, Nitrogen fixation, photosynthesis, function of photosystem II – proposed structures and mechanism of PS II – chlorophyII, reaction center organization – metals in medicine.

UNIT III : SOLID STATE 15 Hrs

Symmetry - point groups, space groups (H.M. notation), lattices, seven crystal systems, structure factor, Patterson map, X-ray studies: single crystal diffraction.– neutron and electron diffraction. Dislocation in solids – Schottky and Frenkel defects – Edge dislocations, 3-dimensional dislocations, nonstoichiometric dislocations. Experimental methods of study of non-stoichiometry. Electrical properties: insulators, semiconductors and super conductors – band theory of solids.

UNIT IV: APPLICATION OF SPECTROSCOPY TO INORGANIC COMPLEXES 15 Hrs

NUCLEAR MAGNETIC RESONANCE (NMR)

Applications in structure determination, NMR studies on exchange reactions between ligands and metal ions. NMR of Paramagnetic complexes – Contact shifts.

ELECTRON SPIN RESONANCE (ESR)

Interactions affecting the energies of unpaired electrons in transition metal ion complexes. – Bissalicylaldiminecopper(II) and ESR spectra of Mn(II) complexes.

MOSSBAUER SPECTROSCOPY (MB)

Theory of quadrupole interactions and magnetic interactions, applications to metal carbonyls and nitrosyls.

UNIT V: CHEMISTRY OF LANTHANIDES AND ACTINIDES 15 Hrs

Chemistry of lanthanides and actinides: Spectral and magnetic properties of Lanthanides and actinides. Coordination compounds lanthanides– use of lanthanide complexes as shift agents – comparative account of lanthanides and actinides.

REFERENCES

1. D.F. Shriver and P.W. Atkins, Inorganic chemistry, Oxford University Press, 3rd edition, 1998
2. Azaroff , Introduction to solids, 1977, TMH edition, Tata. Mc.Graw Hill.
3. R.S. Drago, Physical methods in Inorganic chemistry, Affliated East West press.1965
4. R.S. Drago, Physical methods in chemistry , Saunders Philadelphia.1977
5. Straughan and Walker, spectroscopy, Volume I and II, Chapman and Hall. - 1976
6. James E. Huheey, Inorganic Chemistry, Principles of structure and Reactivity, Dorling Kindersely (India) Pvt Ltd,IV th Edition, 2007.
7. J.D.Lee, Concise Inorganic Chemistry, ELBS, Chapman and Hall Londen ,Vth Edition.,2006.
8. R.S. Drago, Physical methods in chemistry, Sainders College. 1987.

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SEMESTER III
(For those who joined in June 2017 and after)

Part III - Core Subject Theory		
Subject Title **: Physical Chemistry - III**		
Subject Code: **33CT33**	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To have an idea about group theory.*
- *To study about the spectroscopy*
- *To know about the biophysical chemistry.*

UNIT I : GROUP THEORY- I 15 Hrs

Symmetry elements and symmetry operation – point groups – symmetry number from point groups – matrix representation of symmetry operations – reducible and irreducible representations – statement of Great orthogonality theorem – character tables and their constructions – C_{2v}, C_{3v}, C_{2h} point groups.

UNIT II: GROUP THEORY-II 15 Hrs

Application of group theory to normal mode analysis – symmetry selection rules for IR and Raman active fundamentals; symmetry of molecular orbitals and symmetry selection rules for electronic transitions for simple molecules (Ethylene, Formaldehyde and Benzene) Projection operators-SALC procedure-evaluation of energies and HMO's for ethylene and butadiene. Application of group theory to solve hybridization problems (sp^2 and sp^3).

UNIT III: NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY 15 Hrs

Nuclear spin, nuclear resonance, saturation, relaxation processes, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, spin decoupling – selective decoupling, spintickling, Nuclear Overhauser Effect (NOE). NMR studies of nuclei other than proton. ^{13}C NMR - advantages of FT NMR.

UNIT IV: ELECTRON SPIN RESONANCE SPECTROSCOPY 15 Hrs

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Anisotropy in 'g' and hyperfine coupling constants - applications.

NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY

Quadrupole nuclei – quadrupole moments – electric field gradient – coupling constant – splitting – Applications.

UNIT V: BIOPHYSICAL CHEMISTRY 15 Hrs

Buffers: Buffers and their action – Henderson-Hasselbach equation – Buffer capacity – Buffering of blood.

Viscosity: Definition – significance of viscosity in biological systems – Nature of blood flow through different vessels – plot of apparent viscosity of erythrocytes in physiological saline against haematocrit – amoeboid movement.

Surface tension: Definition – Role of pulmonary surfactant – Stability of alveoli – Interfacial tension and Danieli and Davson model.

Isotopes in biology: Tracer technique – meaning – General tracer requirements – Advantages of tracer experiments – Limitations of tracer experiments – Clinical applications.

REFERENCES

1. F.A. Cotton, Chemical application of group theory, 2nd edn, Wiley Eastern Ltd.1997
2. K.V. Raman, Group theory and its application to chemistry, Tata McGrawHill, Comp. Ltd., New Delhi 1990.
3. Ramakrishnan and Gopinathan, Group theroy in chemistry, Vishal Publications.1998
4. B.K. Bhattacharya, Group theory and its chemical applications Himalayan, Publishing House.-1990
5. Colin N.Banwell Fundamentls of Molecular Spectroscopy ,Tata Mc Graw Hill Comp. Ltd., New Delhi-1997
6. R.S. Drago, Physical methods in Chemistry, Sainders college. 1987
7. G.M. Barrow, Introduction to molecular spectroscopy, MC Graw Hill publishing Co.Ltd. New Delhi.- 1994
8. R. Chang, Basic Principles of spectroscopy, Mc Graw Hill publishing Co.Ltd. New Delhi.-1992
9. Upadhyay,Upadhyay and Nash, Biophysical Chemistry, Himalaya Publishing House. III edition 1997.

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SEMESTER III
(For those who joined in June 2017 and After)

Core Subject Practical		
Subject Title **: Inorganic Quantitative Estimation**		
Subject Code:**33CP34**	Hours per week: **5**	Credit: **3**
Sessional Marks: **40**	Summative Marks: **60**	Total Marks: **100**

COMPLEXOMETRIC TITRATION

(Demonstration only – any two experiments)

1. Estimation of Zinc.
2. Estimation of Magnesium.
3. Estimation of Copper.
4. Estimation of Nickel.
   a) By direct method.
   b) By indirect method.

ESTIMATION

(The first metal ion should be estimated by Volumetric and the second by Gravimetric)

1. Estimation of Copper and Nickel.
2. Estimation of Calcium and Magnesium.
3. Estimation of Barium and Zinc.
4. Estimation of Iron and Nickel
5. Estimation of Copper and Zinc.

(Any four estimations only)

PREPARATION

1. Tetrammine Copper (II) sulphate.
2. Potassium Cupric sulphate.
3. Sodium nitroprusside.
4. Potassium Trioxalato aluminate (III).
5. Trithiourea plumbus nitrate.
6. Hexapentammine Cobalt (III).
7. Penta thiourea dicuprous nitrate.
8. Dithiocyanatotetrapyridine Iron (III)
9. Potassium trioxalatoferrate (III).
10. Nitropentammine Cobalt (III).

(Any four preparations only).

M.Sc. Chemistry CBCS Syllabus SEMESTER III

(For those who joined in June 2017and after)

Core Subject Practical		
Subject Title **: Physical Chemistry**		
Subject Code:**33CP35**	Hours per week: **5**	Credit: **3**
Sessional Marks: **40**	Summative Marks: **60**	Total Marks: **100**

CONDUCTIVITY EXPERIMENTS:

1. Determination of cell constant and λ_∞ of strong electrolytes.
2. Verification of Ostwald's dilution law- determination of dissociation constant of weak acid.
3. Saponification of ester followed by conductometric method.
4. Solubility products of sparingly soluble salts.

CONDUCTOMETRIC TITRATIONS:

ACID BASE TITRATIONS

5. Strong acid - strong base - strong acid

6. Strong acid - strong base – mixture of strong acid and weak acid.

DISPLACEMENT TITRATIONS

7. NH_4Cl – NaOH - NH_4Cl

EXPERIMENTS INVOLVING EMF MEASUREMENTS:

8. Determination of single electrode potentials.

9. Determination of pH and dissociation constant of weak acid using Quinhydrone electrode.

POTETIOMETRIC TITRATIONS (REDOX TITRATIONS)

10. FAS - $K_2Cr_2O_7$ - FAS

11. KI-$KMnO_4$-KI + KCl.

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SEMESTER III
(For those who joined in June 2017 and after)

Non Major Elective Paper		
Subject Title **Forensic Chemistry**		
Subject Code: **33NE3A**	Hours per week: **5**	Credit: **5**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To undertake an in-depth study of application of science in crime investigation.*
- *To study the basic concept of narcotic*
- *To gain the knowledge on fundamental aspects of fingerprinting*
- *To derive advanced knowledge in forensic science and applications.*

UNIT I: INTRODUCTION 15 Hrs

Definition – history – facilities offered by various divisions of forensic laboratory – expert – relevancy of expert opinion – value of expert evidences.

UNIT II: ALCOHOL, NARCOTIC AND POISONS 15 Hrs

Alcohol and their effect on the body , collection of samples – drunk driving – determination of alcohol – drug addiction – identification of drug addict – characteristics of drug –toxicology – classification of poison – action of poison on body.

UNIT III: FINGER PRINTS 15 Hrs

Friction ridges and finger prints – individually of finger print – pattern classification and recording of finger prints – tendigit classification – scene of crime prints – latent finger prints – development of fingerprints (physical and chemical method).

UNIT IV: FORENSIC SEROLOGY 15 Hrs

Blood – colour and age of blood stains – collections and examination of blood stains – search for blood stains. Blood typing – paternity testing. Search for semen stains and examination.

UNIT V: ADVANCES IN FORENSIC SCIENCE 15 Hrs

Polygraph – principle – the instrument – environmental conditions-questioning techniques –analysis of polygraph chart. Vice identification spectrograph – principle technique – legal status. DNA fingerprinting – sources of DNA, DNA profiling technique, forensic applications of DNA test.

TEXT BOOK

1. Nbabr BS, Forensic science, SVP national police academy, Hydrabad. 2005.

Reference:

1. T.H. James, Forensic Sciences, Stanley Thomes Ltd. 2000.
2. Richard, Criminalistics – An Introduction to Forensic Science (College Version), 8th Edition, Sofestein, Printice Hall. 2006
3. Nanda and Tewari – Forensic Science in india Avision for the 21st Centurey, Select Publisher, 2001.

M.Sc. Chemistry CBCS Syllabus SEMESTER III

(For those who joined in June 2017 and After)

Non Major Elective Subject		
Subject Title **: Polymer Chemistry**		
Subject Code:**33NE3B**	Hours per week: **5**	Credit: **5**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

UNIT I: INTRODUCTION TO POLYMER

Importance of polymer-Basic concept-monomers and polymers-definition. Classification of polymers on the basis of microstructure, macrostructures and applications (thermosetting and thermoplastics)distinction among plastic,elastomers and fibers. Homo and hetero polymer. Co polymers. Chemistry of polymerization chain polymerization,free radical,ionic, coordination step polymerization Polyaddition and polycondensation miscellaneous ring-opening&group transfer polymerization.

UNIT II : PHYSICAL PROPERTIES AND REACTION OF POLYMERS

Properties:Glass transistion temperature(Tg) Definition-factors affecting (Tg)-relationship between Tg and moleclular weight and melting point. Importance of Tg.molecular weight of polymers:numbr average ,weight average sedimentation,reaction:hydrolysis-hydrogenation-addition-substitutions-cross-linking vulcanition and cyclisations reactions.polymer degradation.basic idea of thermal, photo ,oxidative degradation of polymers.

UNIT III : POLYMERISATION TECHNIQUES AND PROCESSING

Polymerization techniques: bulk,solution, suspention,emulsion,melt condensation interfacial polycondasatin polymerization.polymer processing: calendaring-die casting,rotational casting-comparission.injection moulding.

UNIT IV : CHEMITRY OF COMMERCIAL POLYMERS

General methods of preparation, properties and uses of the following

Polymers:Teflon, pdymethylmethacrylate, PVC,epoxy resins, rubber-styrene and neoprene rubbers, phenol-formaldehydes and urea-formaldehyde resins.

UNITV: ADVANCES IN POLYMERS

Bio polymers-biomaterials. Polymers in medicinal field, high temperature and fire resistant polymers, silicones. Conducting polymers-carbon fibres.(basic idea only)

TEXT BOOK

Billmeyer F.W. Text book of polymer science,Jr.John Wiley and Sons 1984

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SEMESTER IV
(For those who joined in June 2017 and after)

Part III - Core Subject Theory		
Subject Title **: Organic Chemistry – IV**		
Subject Code: 33CT41	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To have an idea about molecular rearrangement*
- *To study about the heterocyclic compounds*
- *To know about the enzymes*
- *To know about synthetic of electro organic synthesis*

UNIT I: FREE RADICAL REACTIONS AND MOLECULAR REARRANGEMENTS 15 Hrs

Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto–oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction

Hoffmann, Schmith, Lossen, Curtius, Beckmann, Fries, Favorski, Bayer–Villiger rearrangements.

UNIT II 15 Hrs

A: HETEROCYCLIC CHEMISTRY

Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans.

B: VITAMINS:

Synthesis of vitamin A, vitamin B (thiamine), vitamin C (ascorbic acid), vitamin E (tocopherols).

C: ANTIBIOTICS:

Structural elucidation of chloramphenicol and penicillin v.

D: BIOORGANIC CHEMISTRY

Introduction – elementary structure and functions of biopolymers such as proteins and nucleic acids.

UNIT III: STEROIDS 15 Hrs

Classification – Stereochemistry and absolute configuration of steroids – Conformational aspects. Structural elucidation of cholestrol. Structure and synthesis of androsterone and testosterone, oestrone, oestradiol, oestriol, equilenin and progesterone. Synthesis of progesterone from stigmasterol and cholesterol. Adrenocartical harmones – cortisone. Bio synthesis of steroids.

UNIT IV: ENYZMES AND SUPRAMOLECULAR CHEMISTRY 15 Hrs

Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Fischer's lock and key hypothesis. Concept and identification of active site by the

use of inhibitors, affinity labeling and enzyme modifications by site-directed mutagenesis. Reversible and irreversible inhibition.

Introduction – Supramolecular chemistry – physical and chemical characteristics of Supramolecules – Molecular recognition and inclusion phenomena – self assembly in to mono and multilayers – Structure, reactions and applications of the following supramolecules. Crown ethers, cyclodextrin, clays, Zeolites, Dendimers, and Fullerenes.

UNIT V: ELECTRO ORGANIC SYNTHESIS 15 Hrs

Experimental factors: The nature of the substrate, the nature of the solvent-supporting electrolyte, the electrode material, the electrode potential, the temperature. General mechanistic considerations: Chemical step proceeding electron transfer, orientation effects. The nature of the first intermediate: Reactions of intermediates formed in electrode process. Conversions of a functional group into another functional group: anodic conversions (oxidation of glycerol, anisyl alcohol and organic sulphides only),cathodic conversions (Reduction of ketone, ketoxime and notro compounds only).

REFERENCES

1. Jerry March, Advanced organic Chemistry – Reactions, Mechanism and structure, John Wiley and sons pvt.Ltd. IVth edition, 2007.
2. P.S. Kalsi, StereoChemistry , conformation and mechanism, Wiley Eastern Ltd - IVth edition 2006,
3. D. Nasipuri, StereoChemistry of organic compounds, Principles and application ,Wiley Eastern Ltd., IInd edition 2006.
4. I.L. Finar, Organic Chemistry Vol. II, ELBS Longman in Chennai, – V th edition 1975.
5. O.P. Agarwal, chemistry of organic Natural products, Vol. I, 37th edition GOEL publishing House, Meerut. 2008.
6. O.P. Agarwal,chemistry of organic Natural products, Vol. II,34th, edition GOEL publishing House, Meerut. 2008
7. Clayden, Greeves, Warren and Worthers, Organic Chemistry, OXFORD University Press, 2007.
8. L. Eberson and Schafer, Organic electro chemistry, Springer –Verlag, 1971.
9. P.S. Kalsi, Bioorganic, inorganic and Supramollecular Chemistry VIth Edition GOEL publishing House,Meerut. 2007.

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SEMESTER IV
(For those who joined in June 2017 and after)

Part III Core Subject Theory		
Subject Title **: Inorganic Chemistry – IV**		
Subject Code: 33CT42	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To have an idea about inorganic photochemistry*
- *To study about the analytical chemistry*

UNIT I: INORGANIC PHOTOCHEMISTRY 15 Hrs

Aspects of inorganic photochemistry – transition metal complexes, photo physical processes and photo chemical reactions. Chemical actinometers – Potassium ferri oxalate, Reineck's salt actinometers – photosubstitution, photoaquation(Chromium ammine complexes), photo redox (Cobalt ammine complexes) and photo isomerisation (Platinum complexes) reactions. Ligand field photochemistry, Chromium (III) complexes, Adamson's rules – photosensitization reactions, oxidative and reductive quenching reactions of excited state tris (2, 2'-bipyridine) Ruthenium(II) complexes. Photochemistry of organometallic complexes – metal carbonyl complexes.

UNIT II: ANALYTICAL CHEMISTRY 15 Hrs

Solvent extraction: principle, distribution ratio and partition coefficient, successive extraction and separation; different methods of extraction systems; Craig extraction.

Light scattering techniques including nephelometry, turbidimetry and Raman spectroscopy. TGA, DTA and DSC techniques.

UNIT III: CHEMISTRY OF NON-TRANSITION ELEMENTS-II 15 Hrs

Peroxo compounds of boron-peroxoborates, Peroxo compounds of carbon-percarbonic acid and Peroxo compounds of sulfur-Caro's, Marshall's acids. relation between structure and reactivity of oxy-acids of nitrogen, phosphorus, sulphur and halogens, Inter halogens, pseudohalogens. Synthesis and structure of xenon fluorides.

UNIT IV: ERROR ANALYSIS 15 Hrs

Principles and practices of statistical methods in research , samples and populations, significant numbers , accuracy , precision , sampling techniques, mean standard deviation, Gaussian distribution, binomial, poison and normal distribution, confidence levels, least square analysis, linear regression, students table , criteria for rejection of data.

UNIT V: FLUROSENT SENSORS FOR TRANSISTION METALS 15 Hrs

The design of a fluorescent chemical sensors –Electron and energy transfer mechanism –discriminating eT and ET mechanisms –Transition metal recognition and sensing:Ni^{II} , Cu^{II}, Fe^{III} -Fluorescence quenching or enhancement for metal ion sensing – Recognition and sensing of Zn^{II} – Anion sensing based on the metal –ligand interaction –Metal containing fluorosensors for amino acids.

REFERENCES

1. Inorganic Chemistry: Principles Of Structure And Reactivity Huheey (James E) Pearson Education, New Delhi 4th Edition - 2007
2. Inorganic Chemistry, D.F. Shriver and P.W. Atkins, Oxford University Press. Chennai 1 Edition - 1993
3. VOGEL's Text book of Quantitative Chemical Analysis. G.H. Jeffery, J. Bassett, J. Mendnam and R.C. Denney. Addison-Wesley Longman Inc. Fifth edition - 1989
4. Fundamentals of Analytical Chemistry, Douglas A.Skoog and Donald M. Harcourt Asia (P) Ltd, Asia 7th edition, 1995
5. B.K. Sharma,Instumental techniques for analytical Chemistry, Editor – Prentice Hall Inc . 1997.

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SEMESTER IV

(For those who joined in June 2017 and after)

Part III - Core Subject Theory		
Subject Title **: Physical Chemistry - IV**		
Subject Code: 33CT43	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *To know about the importance and significance of electrochemistry and its applications*
- *To study about the statistical thermodynamics*
- *To know about the polymer chemistry.*

UNIT I: ELECTROCHEMISTRY- I 15Hrs

Electrode – electrolyte interfaces, polarisable and non-polarisable interfaces, structure of electrical double layer. Electro capillary and double layer capacity measurements, double layer models, Helmholtz, Guoy–Chapman and Stern models, specific adsorption of ions and molecules.

Kinetics of electrode process, current–potential curves, Butler–Volmer relation and its approximations, Tafel relation, charge transfer resistance, Fast processes, Nernst equation from Butler – Volmer equation, electro catalysis.

UNIT II: ELECTROCHEMISTRY – II 15 Hrs

Over voltage, theories of overvoltage – bubble formation, combination of atoms, ion discharge, proton transfer - applications of overvoltage. Principles, instrumentation and applications of polorography. Principles, instrumentation of cyclicvoltametry - general discussion of the cyclicvoltammograms of one electron reversible process (potassium ferrocyanide/potassium ferricyanide), irreversible one electron transfer process and quasireversible reactions. Hydrogen-Oxygen fuel cell.

UNIT III: STATISTICAL THERMODYNAMICS - I 15Hrs

Aim of statistical thermodynamics, definition of state of a system, ensembles, and micro ensembles, micro-canonical and canonical. Boltzmann distribution law and its derivation, population inversion, absolute negative Kelvin temperature. Boltzmann-Planck equation, partition functions, thermodynamic properties from partition function and equilibrium constant.

UNIT IV: STATISTICAL THERMODYNAMICS - II 15Hrs

Quantum statistics, Fermi-Dirac and Bose-Einstein statistics, photon gas, electron gas according to such statistics, Heat capacity of diatomic gases including hydrogen molecule, Einstein's and Debye's theories of heat capacities of solids.

UNIT V: POLYMERS 15 Hrs

Introduction – structures of polymers. Kinetics and mechanisms of polymerization - free radical , ionic and Coordination polymerization – Zeigler–Natta catalysis – condensation polymerization - degree of polymerization, chain length – copolymerization – determination of molecular weight – light scattering, viscosity methods. Process of polymerization – bulk solution, suspension and emulsion polymerization. Polymer additives – use of fillers in plastics- conducting polymers.

REFERENCES

1. Introduction to electrochemistry, Glasstone, Von Nostrand. 1993
2. Electrochemistry, Bockris and Reddy, Vol I and II, Rosetta edition.2002
3. Principles and applications of Electrochemistry, Crow, Chapman and Hall.1988
4. Thermodynamics, Kuriacose and J. Rajaram, Shoban Lal Nagin Chand.1993
5. Physical chemistry, Castellan, Addision Wesley , 1983
6. Introduction to statistical thermodynamics, Hill, Addision–Wesley. III Edition 1983
7. Physical chemistry, Walter J. Moore, Orient Longmans.V Edition - 1976
8. Physical chemistry, Daniels and Alberty, John Willey and sons.1993
9. Textbook of polymer science Billmeyer. JV., Wiley. 1984
10. Contemporary polymer chemistry, Allcock and P.W. Lampc, Prentice Hall, 1981
11. Polymer science, Gowariker, V.R. Viswanathan N.V. and Jeyadev Sreedhar, Wiley,1986

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SEMESTER IV
(For those who joined in June 2017 and After)

Elective Subject		
Subject Title **: Introduction to Nano Science**		
Subject Code:**33EP4A**	Hours per week: **5**	Credit: **5**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

UNIT I: GENERAL INTRODUCTION

Forms of Matter-Crytal structures-Electronic properties of atoms and solids – Surface energy and surface tension-Defining nanodimensional materials- 0D , 1D and 2D nanostyructures – Size dependence of properties – Special properties resulting from nanodimensionality – Potential uses of nanomaterials.

UNIT II: SYNTHESIS OF NANOMATERIALS

General approaches – Nucleation process- Size of the crystal – Influence of nucleation rate on the size of the crystal – Chemical methods – Sol-gel techniques – Control of grain size – Co-precipitation – Hydrolysis – Sonochemical method – Colloidal precipitation – Bottom up and top down approaches – Kinetically confined synthesis of nanoparticles.

UNIT III: PRINCIPLE AND INSTRUMENTATION

Spectrophotometry ,XRD , EXAFS , XPS , SEM , TEM , HR-TEM, AFM – Application to nanomaterials characterization .

UNIT IV: OPTICAL PROPERTIES OF NANOMATERIALS:

UV –Vis, IR absorption – Photoluminescence and stimulated emission – Nonlinear optical mixing – photoconductivity.Magnetic properties: Concepts of dia –, para- , and ferro-magnetism – Exchange correlation – Exchange interaction.
Electrical properties: Electrical conductivity – Hall effect – charge carrier density – Activation energy; Electronic properties – Field emission properties

UNIT V: BIOLOGICAL NANOMATERIALS

Sizes of building blocks – proteins – DNA double nanowire – Enzymes – protein synthesis – Miceles and Vesicles - Biomimetic nanostructures-Worm micelles and Vesicles from block copolymers.

Reference:

1. C.P. poole Jr., F.K. Owens , Introduction to Nanotechnology , John Wiley & Sons, 2003.
2. M.D.Ventra, S.Evoy , J.R.Heflin, Jr., (Eds), Introduction to Nanoscale Science and Technology, Kluwer Academic, 2004.
3. G.Cao., Nanostructures & Nanomaterials - Synthesis, properties and applications, Imperial College Press.
4. C.N.R. Rao, A.Muller, A.K/Cheetham (Eds.)The Chemistry of Nanomaterials:Synthesis, properties and applications, WILEY –VCH Verlag GmbH & Co, KGaA, Weinheim, 2004
5. P.Knauth, J.Schoonman (Eds), Nanostructured Materials: Selected synthetic methods, properties and applications, KLUWER ACADEMIC, 2002
6. .Schmid, Nanoparticle: from Theory to Applications, Wiley _ VCH Verlag, 2004
7. P.Dutta, S.Gupta (Ed), Understanding of Nanoscience and technology, Global Vision Publishing House,2006
8. C.C.Koch, Nanostructured materials: processing, properties and applications, Jaico Publishing House,2006

9. Challa S.S.R. Kumar (Ed) Biological and pharmaceutical Nanomaterials, John Wiley, 2006.

M.Sc. Chemistry CBCS Syllabus

SEMESTER IV
(For those who joined in June 2017 and after)

Elective Subject		
Subject Title **: Chemistry for Nationality Eligibility Test**		
Subject Code: 33EP4B	Hours per week: **5**	Credit: **4**
Sessional Marks: **25**	Summative Marks: **75**	Total Marks: **100**

Objectives:

To enable the students

- *The students will be trained to face entrance examinations for admission towards Research and also to compete the entrance examinations conducted by CSIR,TNPSC, SET, GATE and private industries.*

UNIT –I 15 Hrs

Inorganic Chemistry

Chemical periodicity: Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory).

Physical Chemistry

Basic principles of quantum mechanics: Postulates; operator algebra; exactly- solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.

Organic Chemistry

IUPAC nomenclature of organic molecules including regio- and stereoisomers. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.

UNIT-II 15 Hrs

Inorganic Chemistry

Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.

Physical Chemistry

Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

Organic Chemistry

Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.

UNIT-III 15 Hrs

Inorganic Chemistry

Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications

Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis.Cages and metal clusters.

Physical Chemistry

Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.

Organic Chemistry

Common named reactions and rearrangements – applications in organic synthesis. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.

UINT-IV 15 Hrs

Inorganic Chemistry

Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.

Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.

Physical Chemistry

Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.

Organic Chemistry

Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction – substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic.Pericyclic reactions – electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.

UNIT-V 15 Hrs

Inorganic Chemistry

Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Physical Chemistry

Solid state: Crystal structures; Bragg's law and applications; band structure of solids. Polymer chemistry: Molar masses; kinetics of polymerization. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

Organic Chemistry

Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S). Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids Structure determination of organic compounds by IR, UV-Vis, 1H & 13C NMR and Mass spectroscopic techniques.

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