SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)

Tamil Nadu, India

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DEGREE OF MASTER OF SCIENCE IN CHEMISTRY

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

M.SC. CHEMISTRY PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2020-2021 Onwards)

Programme Outcomes (POs)

PO1	Graduates are prepared to be creators of new knowledge leading to innovation and **entrepreneurship employable** in various sectors such as private, government, and research organizations
PO2	Graduates are trained to evolve new technologies in their own discipline.
PO3	Graduates are groomed to engage in lifelong learning process by exploring their knowledge independently
PO4	Graduates are framed to design and conduct experiments /demos/create models to analyze and interpret data.
PO5	Graduates ought to have the ability of effectively communicating the findings of Physical sciences; incorporating with existing knowledge

Programme Specific Outcomes (PSOs)

PSO1	Human and Social Values and Responsibilities in the context of learning Chemistry
PSO2	Communicative Skills and the Creative scientific mind towards learning chemistry
PSO3	Positive approach towards Environment and Ecology from the Chemistry perspective
PSO4	Critical thinking and the Analytical mind, students develop for the in depth knowledge in advanced-level Chemistry
PSO5	The relevance of extension of Chemistry in the social context for solving social issues
PSO6	Employability Skills shall enable the students to find jobs in core- chemistry and other related fields
PSO7	Entrepreneurial Skills shall empower the students to start their own industries / business in core-chemistry fields
PSO8	Analytical or Experimental Skills make the students capable of doing higher-level research works in the emerging fields of chemistry

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Master of Science (M.Sc.) in Chemistry

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2020-2021 Onwards)

Sl. No.	Nature of the Course	Course Code	Name of the Course	Hours/ Week	Credits	Marks		
						CIA	ESE	Total
SEMESTER I								
1	Core – I	20PCH1C01	Organic Chemistry-I	5	4	25	75	100
2	Core – II	20PCH1C02	Inorganic Chemistry-I	5	4	25	75	100
3	Core – III	20PCH1C03	Physical Chemistry-I	5	4	25	75	100
4	Elective-I/ Elective-II	20PCH1E01 20PCH1E02	Polymer Chemistry / Conducting polymer	5	3	25	75	100
5	Core Practical-I	20PCH1P01	Organic Chemistry Practical - I	5	3	40	60	100
6	Core Practical-II	20PCH1P02	Colorimetry & Kinetic studies	5	3	40	60	100
Total				**30**	**21**	**180**	**420**	**600**
SEMESTER II								
7	Core-IV	20PCH2C04	Organic Chemistry-II	5	4	25	75	100
8	Core-V	20PCH2C05	Inorganic Chemistry-II	5	4	25	75	100
9	Core-VI	20PCH2C06	Physical Chemistry-II	4	4	25	75	100
10	Core Practical-III	20PCH2P03	Physical Chemistry Practical - I	5	3	40	60	100
11	Core Practical- IV	20PCH2P04	Analysis of organic and Inorganic Mixture-I	5	3	40	60	100
12	EDC	---	Extra Disciplinary Course (EDC) (Other than Chemistry	4	4	25	75	100
13	Common Course	20P2HR01	Human Rights	2	2	25	75	100
Total				**30**	**24**	**205**	**495**	**700**

SEMESTER III								
14	Core-VII	20PCH3C07	Organic Chemistry-III	5	4	25	75	100
15	Core-VIII	20PCH3C08	Inorganic Chemistry-III	5	4	25	75	100
16	Core-IX	20PCH3C09	Physical Chemistry-III	5	4	25	75	100
17	Elective-III	20PCH3E03	Spectroscopy	5	3	25	75	100
18	Core Practical- V	20PCH3P05	Inorganic Chemistry Practical - I	5	3	40	60	100
19	Core Practical- VI	20PCH3P06	Conductometric titration and organic estimation	5	3	40	60	100
Total				**30**	**21**	**180**	**420**	**600**
SEMESTER IV								
20	Core-X	20PCH4C10	Organic Chemistry-IV	5	4	25	75	100
21	Core-XI	20PCH4C11	Physical Chemistry-IV	5	4	25	75	100
22	Elective-IV	20PCH4E04	Coordination Chemistry	5	3	25	75	100
23	Core Practical-	20PCH4P07	Organic Chemistry Practical - II	3	3	40	60	100
24	Core Practical-	20PCH4P08	Preparation of Domestic Products	3	3	40	60	100
25	Core Project	20PCH4PR01	Project work	9	7	50	150	200
Total				**30**	**24**	**205**	**495**	**700**
Cumulative Total				**120**	**90**	**710**	**1890**	**2600**

***Core Practical Examinations will be conducted at the end of every semester.**

Note

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

Major Elective Courses

1. Polymer Chemistry
2. Conducting polymer

3. Spectroscopy

4. Coordination Chemistry

Common Course

1. Human rights

Extra Disciplinary Courses (EDC)

1. Extra Disciplinary Course

PROGRAMME SYLLABUS

Program: M.Sc. Chemistry				
Core – I	**Course Code:** 20PCH1C01		**Course Title:** Organic Chemistry-I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	4	100

Course Objectives

1. To learn the concept of stereochemistry, conformational analysis and their application in the determination of reaction mechanism.
2. To learn about the formation, stability and structure of intermediates.
3. To learn about the mechanism of aliphatic and aromatic nucleophilic substitution reactions and aromatic electrophilic substitution reactions.

UNIT I Stereochemistry (15 Hours)

Fischer, Newman and Sawhorse projections and their interconversion. Axial chirality – biphenyls, allenes and spiranes – R, S and E, Z notations. Chirality due to helical shape, planar chirality - Cyclophanes, ansa compounds and trans cyclooctene. Stereospecific and stereoselective synthesis with suitable examples, asymmetric synthesis – Crams rule. Homotopic, enantiotopic, diastereotopic H atoms, groups in organic molecules. Conformational analysis and stereochemical features of disubstituted cyclohexanes (1,2 ; 1,3 ; 1,4 dialkyl cyclo hexanes), conformation and stereochemistry of cis and trans decalins.

UNIT II Reaction intermediates (15 Hours)

Reaction intermediates : Formation, stability and structure of carbonium ions, carbanions, carbenes, nitrenes and free radicals. Free radical reactions : Sandmeyer reaction, Gomberg-Bachmann reaction, Pschorr reaction and Ullmann reaction, Hunsdiecker reaction.

UNIT III Aliphatic Nucleophilic Substitution Reactions (15 Hours)

The SN1, SN2 & SNi mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, anchimeric assistance. Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon.Reactivity effects of substrates structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile, regioselectivity. Williamson reaction, Vonbraun reaction, hydrolysis of esters, Claisen and Dieckmann condensation.

UNIT IV Aromatic electrophilic substitution reactions (15 Hrs)

The arenium ion mechanism, typical reactions like nitration, sulphonation, halogenation, Friedel – Crafts alkylation, acylation and diazonium coupling, electrophilic substitution on monosubstituted benzene, orientation and reactivity – ortho, meta and para directing groups, ortho-para ratio, ipso attack, Gatterman, Gatterman- Koch, Vilsmeir, Houben Hoesch reaction.

UNIT V Aromatic nucleophilic substitution and determination of reaction mechanism (15 Hrs)

Aromatic nucleophilic substitution in aryl halids by Meisenheimer complex mechanism and benzyne mechanism. Various methods of benzyne generation and reactions of benzynes (inter and intramolecular). Reactions of aryldiazonium salts. Zeigler alkylation, Vicarious Nucleophlic Substitution (VNS), Chichibabin and Schiemann reactions.

Kinetic and non-kinatic methods of determining organic reaction mechanism. Hammett and Taft equations – simple problems.

TEXT BOOKS

1. Jerry March, Advanced Organic Chemistry-Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons (1992)

2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc., 1996.

3. P.S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers, 2002.

4. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata McGraw-Hill Publishing Company, 1995.

5. P.S. Kalsi, Stereochemistry – Conformation and Mechanism, 6th Edition, Wiley Eastern Limited, 2005.

6. I.L. Finar, Organic Chemistry, Volume II, Fifth Edition, First Indian reprint, Pearson Education Asia Pte. Ltd., (2000)

REFERENCE BOOKS

1. P.S. Kalsi, Stereochemistry and Mechanism through solved problems, Second Edition, New Age International Publishers, 1994.

2. D. Nasipuri, Stereochemistry of Organic Compounds, 2nd Edition, New Age International Publishers, 1994.

3. S.M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, 1st Edition, Macmillan, 1979

4. R.T. Morrison and R.N. Boyd, Organic Chemistry, 6th Edition, Prentice-Hall, 1992.

5. R.O.C. Norman, Principles of Organic Synthesis, Second Edition, Chapman and Hall, 1978.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	Identify bonding in organic molecules and the structural implications on properties
K2	CO2	Understand the concept of aromatic character in some molecules
K3	CO3	Illustrate the importance of stereochemical aspects of structure and properties
K4	CO4	Analyse the chemical reactions and the mechanisms via different intermediates
K5&K6	CO5	Evaluate the techniques of studying the mechanisms of reactions
K5&K6	CO6	Formulate the nucleophilic substitution reactions shown by organic molecuels

K1– Remember,K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	S	S
CO2	H	S	S	H	M
CO3	M	H	S	S	M
CO4	S	S	H	H	H
CO5	H	M	M	S	S
CO6	H	M	M	M	M

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Core – II		**Course Code:** 20PCH1C02		**Course Title:** Inorganic Chemistry-I
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	4	100

Course Objectives

1. To make students acquainted with basics of crystallography, structure and bonding involved in Inorganic Chemistry and their basics.
2. To study about the Boron compounds and Clusters.
3. To study the recent development in polymeric materials of coordination complexes.

UNIT – I Solid State (15 Hours)

Structure of solids – defects in solids (Frenkel, Schottky types); Non-stochiometric compounds(metal defects). structure of cesium chloride, Rutile, Cadmium Iodide and Nickel Arsenide,Zinc sulphide(Zinc blende and Wurtzite). Electrical, magnetic and optical properties of solids- Band theory, semi-conductors, super conductors.

UNIT II Metal - Ligand Bonding (15 Hours)

Crystal field theory – splitting of d- orbitals under various geometries, factors affecting splitting, CFSE, evidences for CFSE (Structural and thermodynamic effects),Spectrochemical series, Jahn – Teller distortion –Splitting pattern in trigonal pyramid, square pyramidal and cubic symmetrie, Jahn – Teller effect and Chelation; Limitations of CFT.

UNIT III Boron compounds and Clusters (15 Hours)

Boron hydrides – polyhedral boranes, hydroborate ions – a general study of preparation, properties and structure, styx numbers, Wade's rules. Carboranes – types such as closo and nido – preparation, properties and structure. Metallo carboranes – a general study. Metal clusters – Chemistry of low molecularity metal clusters only – structure of Re_2Cl_8; multiple metal – metal bonds.

UNIT –IV Structure and Bonding (15 Hours)

Hard and Soft acids and bases-classifications, Acid-Base strength, hardness, symbiosis, Theoretical basis of Hardness and Softness, applications of HSAB.

Rings-Phosphazenes-Structure, Craig and Peddock model, Dewar model, polyorganophosphazenes, Polysulphur –nitrogen compounds.

Polyacids- Isopolyacids, heteropolyacids of vanadium, chromium, molybdenum and tungsten- properties and structure.

UNIT – V Stereochemistry of Coordination Compounds (15 Hours)

Stereochemical aspects– Stereoisomerism in inorganic complexes, isomerism arising out of ligand conformation and absolute configuration of the complex, chirality and the nomenclature of the chiral complexes – Optical rotatory dispersion (ORD) and Circular Dichroism (CD). Macrocyclic ligands – Crown ethers, Porphyrins, Corrins, Cryptands and Schiff`s bases.

TEXT BOOKS:

1. J.E.Huheey, E.A.Keiter and R.L.Keiter, Inorganic chemistry-principles of structure and reactivity, 4th edition, Pearson-Education, 2002

2. F.A.Cotton and G.Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 5th edition, 1988.

3. E.A.V.Ebsworth, D.WH.Rankine and S.Craddock, Structural methods in Inorganic Chemistry, Black well Scientific publication, 1987

REFERENCE BOOKS:

1. A.W.Adamson and P.Fleischauer, Concepts of Inorganic Photochemistry, Wiley, 1975.

2. H.J.Emelius and Sharpe, Modern aspects of Inorganic chemistry, Universal book stall, New Delhi, 1989

3. F. Basolo and R.G. Pearson, Mechanism of Inorganic Reactions, Wiley Eastern, 1967.

4. S.F.A. Kettle, Coordination compounds, ELBS, 1973.

5. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, WB. Sanders Co. USA. 1977.

6. D.F. Shriver, P. W. Atkins and C.H. Longford, Inorganic Chemistry, ELBS, 2nd Edition, 1994.

7. R.B. Heslop and K. Jones, Inorganic Chemistry, Elsevier, 1976.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	Identify The chemistry of transition and inner transition elements
K2	CO2	Understand the Important compounds of transition metals and their applications
K3	CO3	Illustrate the importance of stereochemical aspects of Coordination compounds
K4	CO4	Analyse the Crystal field stabilization energy and boron clusters
K1&K2	CO5	Evaluate the Metal-Ligand Bonding and properties of solids
K3&K4	CO6	Formulate the styx number and wade's rule in Coordination complexes

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**M**	**H**	**S**	**S**	**H**
CO2	**H**	**S**	**S**	**S**	**H**
CO3	**M**	**H**	**S**	**S**	**H**
CO4	**S**	**S**	**H**	**H**	**H**
CO5	**H**	**M**	**M**	**S**	**S**
CO6	**S**	**S**	**H**	**H**	**M**

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Core – III		**Course Code:** 20PCH1C03		**Course Title:** Physical Chemistry-I
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	4	100

Course Objectives

1. To study in detail the basic concepts of classical thermodynamics and chemical kinetics.
2. To understand the principles of quantum chemistry and group theory

UNIT I – CLASSICAL THERMODYNAMICS-I (15 Hours)

Partial molar properties-Partial molar free energy (Chemical potential) - Partial molar volume and Partial molar heat content - Gibbs - Duhem equation-Significance and determination of these quantities. Variation of chemical potential with temperature and pressure. Determination of chemical potential [Direct Method and Method of Intercepts]

UNIT II – CLASSICAL THERMODYNAMICS-II (15 Hours)

Thermodynamics of real gases – definition of fugacity - determination of fugacity - variation of fugacity with temperature and pressure –Maxwells relation– Duhem Margulus equations. Solution of electrolytes – Concept of ionic strength-.mean ionic activity and mean ionic activity coefficient – determination of activity coefficient from freezing point, EMF and solubility measurements.

UNIT III –CHEMICAL KINETICS – I (15 Hours)

Theories of reaction rates – Arrhenius theory, Hard sphere collision theory and transition state theory of reaction rates– Comparison of collision theory and activated complex theory – Lindemann and Hinshelwood theories of unimolecular reaction rates. Reactions in solutions – comparison between gas phase and solution reactions – influence of solvent, ionic strength, and pressure on reactions in solution – Kinetic isotope effects.

UNIT IV– CHEMICAL KINETICS -II (`15 Hours)

Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions, general treatment of chain reactions-chain length-Rice Herzfeld mechanism-explosion limits. Study of fast reactions- relaxation methods-temperature and pressure jump methods-stopped flow and flash photolysis method.

UNIT V- QUANTUM CHEMISTRY-I (15 Hours)

Planck's theory of black body radiation – Photoelectric effect; de – Broglie equation – Heisenberg uncertainty principle – Compton Effect; operators and commutation relations – quantum mechanical postulates – Schrodinger equation and its solution to the problem of a particle in one and three dimensional boxes.

REFERENCE BOOKS:

1. W.J. Moore, Physical Chemistry, Orient Longman, London, 1972.
2. K.G. Den beigh, Thermodynamics of Steady state, Meklien and Co., London, 1951.
3. L.K. Nash, Elements of Chemical Thermodynamics, Addison Wesley, 1962.
4. R.G.Frost and Pearson, Kinetics and Mechanism, Wiley, Newyork, 1961.
5. J.W. Moore and R.G. Pearson, Kinetics and Mechanism, 1981.
6. C.Capellos and B.H.J. Bielski, Kinetic systems, Willey interscience, Newyork, 1968
7. G.M.Harris, Chemical Kinetics, D.C. Heath and Co., 1966.
8. D.A. Mc Quarrie, Quantum Chemistry, University science books, Mill Valley, California(1983).
9. P.W.Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford., 1983
10. N.Levine, Quantum chemistry, Allyn and Bacon, Boston, 1983.
11. F.J.Bockhoff, Elements of Quantum theory, Addision Wesley, Reading, Mass, 1976.
12. H.Eyring, J.Walter and G. Kimball, Quantum chemistry, John wiley and sons, Newyork, 1944.
13. L.S.Pauling and E.B.Wilsob, Introduction to Quantum Mechanics, Mc Graw Hill book Co., Newyork, 1935.
14. F.A. Cotton, Chemical Application of Group Theory, John Wiley and Sons Inc., Newyork, 1971.
15. N.Tinkham, Group Theory and Quantum Mechanics, McGraw Hill Book Company,Newyork, 1964.

TEXT BOOKS:

1.Gurudeep raj, Advanced Physical Chemistry, Goel Publishing House, Meerut.
2.J. Rajaram and J.C. Kuriacose, Thermodynamics for students of chemistry, Lal Nagin Chand, New Delhi, 1986.
3. S.Glasstone, Thermodynamics for chemists, Affiliated East West press, New Delhi, 1960
4.J. Rajaram and J.C. Kuriacose, Kinetics and mechanism of chemical transformation, Macmillan India Ltd., 1993.
5. K.J.Laidler, Chemical Kinetics, Harper and Row, Newyork, 1987.
6. R.K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 1992.
7. M.W. Hanna, Quantum mechanics in chemistry, W.A. Benjamin INC, London (1965)
8. A.K. Chandra, Introductory Quantum Chemistry, Tata Mc Graw Hill.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	Identify the theories of reaction rates
K2	CO2	Understand the concept of potential energy contour plots
K3	CO3	Illustrate the importance of concepts and applications of reaction kinetic chemistry
K4	CO4	Analyse the Acid-base and enzyme catalysis concepts
K1&K2	CO5	Evaluate the rate of the chemical reactions
K3&K4	CO6	Formulate the quantum mechanical postulates & Schrodinger equation

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	M	H
CO2	H	M	S	M	H
CO3	M	H	S	M	H
CO4	S	M	H	M	H
CO5	H	M	M	M	M
CO6	S	S	H	H	M

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Elective - I		**Course Code:** 20PCH1E01		**Course Title:** Polymer Chemistry
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	3	100

Course Objectives:

1. To study the basic concepts in polymer chemistry.
2. To learn about the kinetics and types of co-ordination polymerization.
3. To study the measurement of molecular weight and the properties of polymers.
4. To study about the polymer processing and properties of commercial polymers.

UNIT I Basic Concepts (15Hours)

Monomers, repeat units, degree of polymerization, Linear, branched and network Polymers. Condensation Polymerization : Mechanism of stepwise polymerization. Kinetics and statistics of linear stepwise polymerization. Addition polymerization : Free radical, cationic and anionic polymerization. Polymerization conditions. Polymerization in homogeneous and heterogeneous systems.

UNIT II Co-ordination Polymerization (15 Hours)

Kinetics, mono and bimetallic mechanism of co-ordination polymers. Zeigler Natta catalyst, co-polymerization: Block and graft co-polymers, kinetics of copolymerization. Types of co-polymerization. Reactivity ratio.

UNIT III Molecular Weight and Properties (15 Hours)

Polydispersion – average molecular weight concept, number, weight and viscosity average molecular weights. Measurement of molecular weights. Viscosity, light scattering, osmotic and ultracentrifugation methods. Polymer structure and physical properties – crystalline melting point Tm. The glass transition temperature. Determination of Tg. Relationship between Tm and Tg.

UNIT IV Electrochemical Synthesis

Electrochemical synthesis of conducting polymers – monomers, electrolytic condition, electrodes and mechanism; Electrochemical synthesis of derivatives of poly pyrrole, polythiophene, polyazulene, polycarbazole, polyindole, polyaniline and polyphenylene.

UNIT V Properties of Commercial Polymers (15 Hours)

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers, Fire retarding polymers and electrically conducting polymers. Biomedical polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

TEXT BOOKS:

1. H.R. Alcock and F.W. Lamber, Contemporary Polymer Chemistry, Prentice Hall, 1981.
2. P.J. Flory, Principles of Polymer Chemistry, Cornell University press, New York, 1953.
3. G. Odian, Principles of Polymerization, 2nd Edition, John Wiley & Sons, New York,19 81.

REFERENCE BOOKS:

1. F.W. Billmeyer, TextBook of Polymer Science, 3rd Edition, J.Wiley, 2003.
2. V. R. Gowariker, N.V. Viswanathan and J. Sreedhar, Polymer Science, New Age Int., 1986.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	Identify polymers
K2	CO2	Understand Free radical, cationic and anionic polymerization
K3	CO3	Illustrate the kinetics and types of co-ordination polymerization
K4	CO4	Analyse the Properties of Commercial Polymers
K1&K2	CO5	Evaluate the molecular weight and the properties of polymers.
K3&K4	CO6	Design the Electrochemical synthesis of conducting polymers

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	H	M
CO2	H	M	M	M	M
CO3	H	M	M	H	H
CO4	S	M	H	M	M
CO5	H	M	M	M	M
CO6	M	S	H	H	M

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Elective - II	**Course Code:** 20PCH1E02		**Course Title:** Conducting Polymer	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	3	100

Course Objectives

1. To study the basic concepts and synthetic methods.
2. To learn about the Electrochemical Synthesis.
3. To study about the Semiconducting and Metallic Polymers.
4. To study about Doping.
5. To learn about the Catalytic Conducting Polymers.

UNIT – I Basic Concepts and Synthetic methods

Basics of conducting polymers - Organic - conjugated unsaturated hydrocarbons- Chemical Synthesis of conducting polymers – Other synthetic methods.

UNIT – II Electrochemical Synthesis

Electrochemical synthesis of conducting polymers – monomers, electrolytic condition, electrodes and mechanism; Electrochemical synthesis of derivatives of poly pyrrole, polythiophene, polyazulene, polycarbazole, polyindole, polyaniline and polyphenylene.

UNIT – III Semiconducting and Metallic Polymers

Structural basis for semiconducting and metallic polymers – introduction; Organic meta polymers - Synthetic route, isomers and electronic structure (polymers like polyacetylene, poly(p-phenylene), polypyrrole, polythiophene, etc.,).

UNIT – IV Doping

Electrochemical doping; deadline to the development of conducting polymers; role of reduction and oxidation potential in doping; polyacetylene as electrode materials.

UNIT – V Catalytic Conducting Polymers

Catalytic properties of conducting polymers; catalysis of electron donor-acceptor complexes; electrocatalysis by semiconducting polymers.

TEXT BOOKS

1) Terje A. Skotheim, Ronald L. Elsenbaumer, John R. Reynolds, Handbook of Conducting Polymers, Second Edition, Marcel Dekkar, 1995.

2) Hari Singh Nalwa (Edn), Handbook of Organic Conductive Molecules and Polymers, Four Volumes, Wiley, 1997

REFERENCE BOOKS

1) Jean-Pierre Farges, Organic Conductors, Marcel Dekkar, 1994

2) David B Cotts, Z Reyes, Electrically Conductive Organic Polymers for Advanced Applications, William Andrew Inc,1987

3) Larry Rupprecht, Conductive Polymers and Plastics, William Andrew Inc, 1999.

4) Raymond B Seymour, New Concepts in Polymer Science, Polymeric Composites, VSP, 1990.

5) Wallace Gordon, Gordon G Wallace, Geoffrey M Spinks, Conductive Electroactive Polymers, CRC Press, 2002

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	Identify polymers
K2	CO2	Understand the Electrochemical synthesis of conducting polymers
K3	CO3	Illustrate the Catalytic properties of polymerization
K4	CO4	Analyse the Synthetic route of Polymers
K1&K2	CO5	Evaluate the reduction and oxidation potential in doping.
K3&K4	CO6	Design the Structural basis for semiconducting and metallic polymers

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**M**	**H**	**S**	**S**	**M**
CO2	**S**	**S**	**H**	**H**	**H**
CO3	**H**	**M**	**M**	**S**	**S**
CO4	**S**	**S**	**H**	**H**	**M**
CO5	**M**	**H**	**S**	**H**	**M**
CO6	**S**	**S**	**H**	**H**	**H**

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Core Practical – I	**Course Code:** 20PCH1P01		**Course Title:** Organic Chemistry practical - I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	45	3	100

Course Objectives

1. To learn the preparation techniques, Extraction and Analytical methods

1) Any Six preparations from the following

(i) Preparation of o-benzyl benzoic acid

(ii) p-Nitrobenzoic acid from p-nitrotoluene

(iii) Anthraquinone from anthracene

(iv) Benzhydrol from Benzophenone

(v) m-Nitroaniline from m-dinitrobenzene

(vi) 1,2,3,4 – Tetrahydrocarbazole from cyclohexanone

(vii) p-chlorotoluene form p-toluidine

(viii) 2,3 – Dimethylindole from phenyl hydrazine and 2 – butanone

(ix) Methyl orange form sulphanilic acid

(x) Diphenyl methane from benzyl chloride

2) A) Extraction.

(i) Caffine from Tea Dust,

(ii) Lactic Acid from Milk

(iii) Citric Acid from Lemon

(iv) Jasmine from Rose

(OR)

B) Instrumental Analysis. (Any one of the following)

i) Identification of Chromophores using FTIR/ UV Spectroscopy

ii) Analysing simple organic substances using Gas Chromatography.

iii) Analysing the purity of the prepared organic compounds given in the section-1 using TLC and Coloum Chromatography.

Preparation	10 Marks
Recrystalisation	10 Marks
Extraction or Inst.Analy	20 Marks
Practical Viva	10 Marks
Record	10 Marks
Total	**60 Marks**

References

1. Ganapragasam and Ramamurthy G, Organic Chemistry Lab Manual, 2nd Ed., S. Vishwanathan Printers and Publishers (P) Ltd., Chennai, 2007.

2. Furniss B S, Hannaford A J, Smith P W G and Tatchell A R, Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Pearson Publication.

3. Vengataswaran V et al., Basic Principle of Practical Chemistry, Sultan Chand and sons, New Delhi, 1997.

Course Outcomes:

1. Learn the separation of binary organic mixtures
2. Understand the green chemistry concepts
3. Skills of doing microlevel analysis
4. Know the methods of qualitative analysis of organic compounds
5. Evaluate the single stage preparation of organic compounds
6. Formulate about the derivative of the organic functional groups

Program: M.Sc. Chemistry				
Core Practical – II	**Course Code:** 20PCH1P02		**Course Title:** Colorimetry & Kinetic Studies	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	45	3	100

Course Objectives

1. To learn Inorganic complex preparation and colorimetric techniques and to study the experiments in chemical equilibrium and chemical kinatics.

I) Preparation of the following:

(a) Potassium tris (oxalato) aluminate (III) trihydrate

(b) Tris (thiourea) copper (I) chloride

(c) Potassium tris (oxalato) chromate (III) trihydrate

(d) Sodium bi (thioshulphato) cuprate (I)

(e) Tris (thiourea) copper (I) sulphate

(f) Sodium hexanitrocobaltate (II)

(g) Chloropentammine cobalt (III) chloride

(h) Bis (acetylacetanato) copper (II)

(i) Hexammine nickel (II) chloride

(j) Bis (thiocyanato) pyridine manganese (II)

II) COLOURIMETRIC ANALYSIS

Colourimetric analysis of Iron, Nickel, Manganese and Copper

a) Using 1,10 Phenantharene - Suggestion

b) Flame Photometry – Suggestion

III) Kinetics Studies

1. Determination of the relative acidity ratio for the hydrolysis of ester in presence of two different acids.

2. Determination of the temperature coefficient and Activation energy of hydrolysis of Ethyl Acetate.

3. Study the kinetics of inversion of cane sugar in the presence of acid using Polarimeter.

4. Study of the kinetics of persulphate oxidation.

5. Study of the kinetics of Iodination of Acetone.

Practical	- 40 Marks
Viva-Voce	- 10 Marks
Record	- 10 Marks
Total	- 60 Marks

References

1. Venkateswaran V, Veeraswamy R., Kulandaivelu A.R., Basic Principles of Practical Chemistry, 2nd Ed., New Delhi, Sultan Chand & sons, 1997.
2. Daniels et al., Experimental Physical Chemistry, 7th Ed., New York, McGraw Hill, 1970.
3. Findlay A, Practical Physical Chemistry, 7th Ed., London, Longman,1959.

Course Outcomes:

1. Learn the separation of binary organic mixtures
2. Understand the green chemistry concepts
3. Skills of doing microlevel analysis
4. Know the methods of qualitative analysis of organic compounds
5. Evaluate the single stage preparation of organic compounds
6. Formulate about the derivative of the organic functional groups

Program: M.Sc. Chemistry				
Core - IV		**Course Code:** 20PCH2C04		**Course Title:** Organic Chemistry - II
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	4	100

Course Objectives

1. To learn the mechanism of Addition and Elimination reactions.
2. To understand the basic concepts of aromaticity.
3. To study the various types of rearrangements and reagents in organic chemistry
4. To learn the uses of oxidation and reducing reagents in organic synthesis.

UNIT I Addition to Carbon – Carbon and Carbon – Hetero atom multiple bonds. (15 Hours)

Addition of halogen and nitrosyl chloride to olefins, hydration of olefins and acetylenes, hydroboration, hydroxylation - cishydroxylation (OsO_4 & $KMnO_4$), transhydroxylation (Prevost reaction and Woodward modification), epoxidation, Michael addition, 1,3 dipolar addition, carbenes and their additions, Diels- Alder reaction.

Mechanism and applications of Mannich, Stobbe, Darzen Glycidic ester condensation. Benzoin condensation, Peterson olefination (Silyl Wittig reaction), Strecker synthesis, Wittig, Wittig - Horner, Perkin, Thorpe, Ritter, Prins reactions.

UNIT II Aromaticity (15 Hours)

Aromatic character: Five-, six-, seven-, and eight-membered rings - other systems with aromatic sextets - Huckel's theory of aromaticity, concept of homoaromaticity and antiaromaticity. Electron occupancy in MO's and aromaticity - NMR concept of aromaticity and antiaromaticity, systems with 2,4,8 and 10 electrons, systems of more than 10 electrons (annulenes), Mobius aromaticity. Bonding properties of systems with $(4n+2)\pi$-electrons and $4n\pi$ - electrons, alternant and non-alternant hydrocarbons (azulene type) - aromaticity in heteroaromatic molecules, sydnones and fullerenes.

UNIT III Molecular Rearrangements (15 Hours)

A detailed study of the mechanism of the following rearrangements. Wagner – Meerwin, Demyanov, Dienone- Phenol, Favorski, Baeyer – Villiger, Wolff, Stevens, Von– Richter, Beckmann, Hydroperoxide, Smiles, Jacobsen, Hofmann – Martius rearrangements (a few examples in each rearrangement are to be studied).

UNIT IV Oxidation and Reduction Reactions (15 Hours)

Study of the following oxidation reactions with mechanism: Oxidation of alcohols by CrO , DMSO alone, DMSO in combination with DCC; acetic anhydride and oxalyl chloride, oxidation of arylmethane, oxidation of methylene alpha to carbonyl, allylic oxidation of olefins, oxidative cleavage of glycols, oxidative cleavage of double bonds by ozonolysis. Study of the following reduction reactions with mechanism; Reduction of carbonyl compounds by complex metal hydrides (LAH, NaBH4, NaBH3CN), clemmensen and Wolff Kishner reductions, Birch reduction, MPV reduction.

UNIT V Reagents in Organic Synthesis (15 Hours)

Reagents and their uses: DCC, DDQ, DBU, DIBAL, 9BBN, NBS, 1,3 – dithiane (umpolung), n-Butyl Lithium, trimethyl silyl iodide, trimethyl silyl chloride, Lithium dimethyl cuprate, Baker's yeast and Gilman's reagent.

TEXT BOOKS

1. Jerry March, Advanced Organic Chemistry-Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons (1992)

2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc., 1996.

3. P.S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers, 2002.

4. Charles H.Depuy, molecular reactions and photochemistry, Orville L.Chapman.Prentice Hall of India Pvt Ltd. New Delhi 1988.

5. I.L. Finar, Organic Chemistry, Volume II, Fifth Edition, First Indian reprint, Pearson Education Asia Pte. Ltd., (2000)

REFERENCE BOOKS

1. S. H. Pine, J.B. Hendrickson, D.J. Cram and G.S. Hammond, Organic Chemistry, IV Edn., McGraw Hill Company, 1980.

2. S.M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, 1st Edition, Macmillan, 1976.

3. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice-Hall, 1992.

4. R.O.C. Norman, Principles of Organic Synthesis, Second Edition, Chapman and Hall, 1978.

5. S.M. Mukherji and S.P. Singh, Reaction Mechanism in Organic Chemistry, IIIEdn. 1984. MacMillan.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	Identify the addition reactions in carbon-carbon unsaturated bonds
K2	CO2	Understand the the different kinds of electrophilic mechanisms in both aromatic and aliphatic compounds
K3	CO3	Illustrate the addition reactions to carbon-hetero atom multiple bonds
K4	CO4	Analyse the mechanisms of elimination reactions and their name reactions
K1&K2	CO5	Evaluate the synthetic uses of the different oxidants and reductants used in organic synthesis.
K3&K4	CO6	Rewrite, prepare and learn some selected topics on synthetic organic chemistry by themselves through online study

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	M	H
CO2	S	M	M	H	H
CO3	H	M	M	M	H
CO4	M	H	S	H	M
CO5	S	H	M	H	H
CO6	H	M	M	M	M

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Core - V		**Course Code:** 20PCH2C05		**Course Title:** Inorganic Chemistry - II
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	4	100

Course Objectives

1. To make the students acquaint themselves with nuclear chemistry.
2. To learn about the various theories of complexes, mode of coordination with various geometry.

UNIT I: NUCLEAR CHEMISTRY – I (15 Hours)

Nucleus: nuclear structure - stability of nuclei - packing fraction - even - odd nature of nucleons - n/p ratio - nuclear potential - binding energy and exchange forces – shell model and liquid drop model. Decay of radionuclei: rate of decay - determination of half-life period - secular equilibrium and decay series. Modes of decay: alpha, beta, gamma and orbital electron capture - nuclear isomerism - internal conversions – Q value - nuclear cross section - threshold energy and excitation functions. Particle acceleration and counting techniques: linear accelerator - cyclotron and synchrotron - betatron - G. M. counter - proportional and scintillation counters.

UNIT II: NUCLEAR CHEMISTRY – II (15 Hours)

Different type of nuclear reactions with natural and accelerated particles - transmutation - stripping and pick-up - spallation - fragmentation, etc. - fission - characteristics of fission reaction –atom bomb - nuclear fusion – stellar energy - synthesis of new elements - principles underlying the usage of radioisotopes in analysis - agriculture - industry and medicine - mechanism of chemical reactions - uses of radioisotopes in analytical chemistry - isotopic dilution analysis – neutron activation analysis and dating methods..

UNIT III: Electronic Spectroscopy of transition metals (15 Hours)

Spectroscopic Term symbols for d^n ions – derivation of term symbols and ground state term symbol, Hund's rule; Selection rules – break down of selection rules, spin-orbit coupling, Energy level diagrams; Orgel and Tanabe – Sugano diagrams; effect of distortion and spin orbit coupling on spectra; Evaluation of Dq and B values for octahedral complexes of Nickel; Charge transfer spectra. Spectral properties of Lanthanides and Actinides.

UNIT – IV Organometallic Chemistry **(15 Hours)**

Carbonyls – 18 electron rule, isolobal concept – application to structure of carbonyls (simple and polynuclear); Chain Carbon donors - Olefins, acetylene and allyl complexes – Synthesis, structure and bonding; Cyclic carbon donors -Metallocene – synthesis, structure and bonding (Ferrocene only). Nitrosyls – bridging and terminal nitrosyls, bent and linear nitrosyls; Substitution – electrophilic and nucleophilic attack on ligands. Carbonylation and decarbonylation; oxidative addition and reductive elimination to organometallics; fluxional isomerism

UNIT – V Catalysis **(15 Hours)**

Hydrogenation of olefins (Wilkinson's catalyst); hydroformylation of olefins using Cobalt or Rhodium catalysts (oxo process); Oxidation of olefins to aldehydes and ketones (Wacker process); polymerization (Zeigler- Natta catalyst); Cyclo oligomerization of acetylene using Nickel catalyst (Reppe's catalyst); polymer bound catalysts.

TEXT BOOKS

1. J.E.Huheey, E.A.Keiter and R.L.Keiter, Inorganic chemistry-principles of structure and reactivity, 4th edition, Pearson-Education, 2002
2. F.A.Cotton and G.Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 5th edition, 1988.
3. E.A.V.Ebsworth, D.WH.Rankine and S.Craddock, Structural methods in Inorganic Chemistry, Black well Scientific publication, 1987
4. W.J.Moore – Physical Chemistry
5. L.V.Azroff – Introduction to solids
6. S.Glasstone – Source book on atomic energy
7. H.J.Arnikar – Essentials of Nuclear chemistry.

REFERENCE BOOKS

1. W.E.Addision – structural principles of Inorganic Chemistry
2. N.B.Hannay – Solid state chemistry
3. R.A.Alberty – Physical chemistry
4. G.Friedlander, J.W.Kennedy, - Nuclear and Radiochemistry E.S.Macias and J.M.Miller
5. A.W.Adamson and P.Fleischauer, Concepts of Inorganic Photochemistry, Wiley, 1975.

6. H.J.Emelius and Sharpe, Modern aspects of Inorganic chemistry, Universal book stall, New Delhi, 1989

7. F. Basolo and R.G. Pearson, Mechanism of Inorganic Reactions, Wiley Eastern, 1967.

8. S.F.A. Kettle, Coordination compounds, ELBS, 1973.

9. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, WB. Sanders Co. USA. 1977.

10. D.F. Shriver, P. W. Atkins and C.H. Longford, Inorganic Chemistry, ELBS, 2nd Edition, 1994.

11. R.B. Heslop and K. Jones, Inorganic Chemistry, Elsevier, 1976.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	Identify the addition reactions in Inorganic compounds
K2	CO2	Understand the applications of nuclear chemistry in theoretical and analytical fields
K3	CO3	Illustrate the Inorganic reaction mechanism
K4	CO4	Analyse the Concept of nuclear energy and nuclear reactions
K1&K2	CO5	Evaluate the need of nuclear energy to the expanding human society
K3&K4	CO6	Compile Various atomic power projects in India

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	M	H
CO2	S	M	M	H	H
CO3	H	M	M	M	H
CO4	M	H	S	H	M
CO5	S	H	M	H	H
CO6	H	M	M	M	M

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Core - VI		**Course Code:** 20PCH2C06		**Course Title:** Physical Chemistry - II
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	4	60	4	100

Course Objectives

1. To impart knowledge on surface chemistry and its significance.
2. To study the different types of molecular spectroscopy.
3. To study in detail the basic concepts of statistical thermodynamics.
4. To understand the principles and applications group theory

UNIT I – SURFACE PHENOMENA (15 Hours)

Gibbs adsorption isotherm- B.E.T isotherm- – Determination of surface area using B.E.T – Heterogeneous catalysis – Mechanism - Langmuir - Hinshelwood Mechanism - Langmuir - Rideal bimolecular mechanism -kinetics of heterogeneous reactions. Mechanism and kinetics of enzyme catalyzed reactions.

UNIT II – QUANTUM CHEMISTRY-II (15 Hours)

Application of Schrödinger equation to rigid rotator,helium atom and hydrogen atom - Approximation methods –Perturbation method –The perturbation theory- firstorder and second order perturbation - Variation method to hydrogen atom

UNIT III– ELEMENTS OF GROUP THEORY (15 Hours)

Symmetry elements and symmetry operations – Groups – rules for forming a group, cyclic group, abelian group, sub group- group multiplication table – sub groups, similarity transformation and classes – identifications of symmetry operations and determination of point groups – Matrix representations - reducible and irreducible representations – direct product representation – Mulli Kevi's Motations.

UNIT IV – APPLICATIONS OF GROUP THEORY (15 Hours)

Great Orthogonality theorem (GOT) and its consequences – construction of character table for C2V and C3V – hybrid orbitals in non linear molecules (CH4, BF3, SF6 and NH3). Determination of representations of vibrational mode analysis in non linear molecules (H2O, CH4, BF3, and NH3). Symmetry selection rules of infra-red and Raman spectra – application of group theory for the electronic spectra of ethylene and formaldehyde.

UNIT V - Statistical Thermodynamics (15 Hours)

Concept of thermodynamical and mathematical probabilities – Distribution of distinguishable and non – distinguishable particles. Maxwell –Boltzmann, Bose-Einstein and Fermi-Dirac statistics – comparisions. Partition functions – rotational, vibrational, translational and electronic partition functions- Expression of equilibrium constant in terms of partition function – Einstein and Debye theory of heat capacities of solids.

REFERENCE BOOKS

1. W.J. Moore, Physical Chemistry, Orient Longman, London, 1972.
2. K.G. Den beigh, Thermodynamics of Steady state, Meklien and Co., London, 1951.
3. L.K. Nash, Elements of Chemical Thermodynamics, Addison Wesley, 1962.
4. R.G.Frost and Pearson, Kinetics and Mechanism, Wiley, Newyork, 1961.
5. J.W. Moore and R.G. Pearson, Kinetics and Mechanism, 1981.
6. C.Capellos and B.H.J. Bielski, Kinetic systems, Willey interscience, Newyork, 1968
7. G.M.Harris, Chemical Kinetics, D.C. Heath and Co., 1966.
8. A.K. Chandra, Introductory Quantum Chemistry, Tata Mc Graw Hill.
9. D.A. Mc Quarrie, Quantum Chemistry, University science books, Mill Valley, California (1983).
10. P.W.Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford., 1983
11. I.N.Levine, Quantum chemistry, Allyn and Bacon, Boston, 1983.
12. F.J.Bockhoff, Elements of Quantum theory, Addision Wesley, Reading, Mass, 1976.
13. H.Eyring, J.Walter and G. Kimball, Quantum chemistry, John wiley and sons, Newyork, 1944.
14. L.S.Pauling and E.B.Wilsob, Introduction to Quantum Mechanics, Mc Graw Hill book Co., Newyork, 1935.
15. F.A. Cotton, Chemical Application of Group Theory, John wiley and Sons Inc., Newyork, 1971.
16. N. Tinkham, Group Theory and Quantum Mechanics, McGraw Hill Book Company, Newyork, 1964. 17. Alan Vincent, Molecular Symmetry and Group theory –Programmed Introduction to chemical applications, Wiley, Newyork, 1977.

TEXT BOOKS

1. S.Glasstone, Thermodynamics for chemists, Affiliated East West press, New Delhi, 1960.
2. J. Rajaram and J.C. Kuriacose, Thermodynamics for students of chemistry, Lal Nagin Chand, New Delhi, 1986.

3. J. Rajaram and J.C. Kuriacose, Kinetics and mechanism of chemical transformation, Macmillan India Ltd., 1993.

4. K.J.Laidlar, Chemical Kinetics, Harper and Row, Newyork, 1987.

5. R.K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 1992.

6. M.W. Hanna, Quantum mechanics in chemistry, W.A. Benjamin INC, London (1965)

7. V.Ramakrishnan and M.S.Gopinathan, Group theory in chemistry, Vishal Publications, 1988.

8. K.V.Raman, Group theory and its application to chemistry, Tata McGraw Hill Publishing Co., 1990.

9. Gurudeep raj, Advanced Physical Chemistry, Goel Publishing House, Meerut.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

Knowledge Level	COs Number	CO Statement
K1	CO1	learn the concept of classical mechanics
K2	CO2	Understand the concepts of mathematics of quantum chemistry and group theory
K3	CO3	Illustrate the concept of group theory
K4	CO4	Analyse the concept of building a character table
K1&K2	CO5	Evaluate the hybridization and crystal symmetry
K3&K4	CO6	Formulate the concepts of Schrodinger wave equation

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**M**	**M**	**M**	**M**	**M**
CO2	**S**	**H**	**H**	**H**	**H**
CO3	**M**	**H**	**S**	**H**	**M**
CO4	**S**	**H**	**S**	**H**	**S**
CO5	**S**	**M**	**M**	**H**	**H**

S - Strong **H** - High **M** - Medium **L** – Low

Program: M.Sc. Chemistry				
Core Practical - III	**Course Code:** 20PCH2P03		**Course Title:** Physical Chemistry Practical - I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	3	100

Course outcomes:

1. Students learn and understand the concept Electrode potential
2. The concept of Salting out constant is learnt
3. Students learn and understand the concepts of Conductometric titrations
4. Students learn and understand the concepts of Potentiometric titrations
5. The concepts and measurement of equivalent conductance is learnt
6. Redox properties of ionic species is well understood

To learn the experiments in Phase equilibrium

1. Construct the phase diagram for a simple binary system naphthalene – Biphenyl and benzophenone - Diphenyl amine.
2. Study the simultaneous distribution of benzoic acid in benzene – water system.
3. Determine the equilibrium constant of the reaction between iodine and potassium iodide by partition method and determine the concentration of the given unknown KI solution
4. Study the adsorption of acetic acid by charcoal.
5. Determination of molecular weight of the substance by Rast method.
6. Effect of Nacl on CST of phenol-water system and determination of the strength of Nacl.

Total 75 Marks

Practical	40 Marks
Viva-Voce	10 Marks
Record	10 Marks
Total	75 Marks

References

1. Venkateswaran V, Veeraswamy R., Kulandaivelu A.R., Basic Principles of Practical Chemistry, 2nd Ed., New Delhi, Sultan Chand & sons, 1997.

2. Daniels et al., Experimental Physical Chemistry, 7th Ed., New York, McGraw Hill, 1970.

3. Findlay A, Practical Physical Chemistry, 7th Ed., London, Longman,1959. 34

Program: M.Sc. Chemistry				
Core Practical - IV	**Course Code:** 20PCH2P04		**Course Title:** Analysis of Organic & Inorganic Mixture - I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	3	100

Course Outcomes:

1. Learn the separation of binary inorganic mixtures
2. Skills of doing microlevel analysis
3. Know the methods of qualitative analysis of organic compounds
4. Evaluate the single stage preparation of organic compounds
5. Formulate about the derivative of the organic functional groups

I) INORGANIC MIXTURE

a) Semimicro qualitative analysis of mixture containing two common and two rare cations.

b) The following are the rare cations to be included. W, Ti, Te, Se, Ce, Th, Zr, V, U, Li, Mo.

c) Estimation of hardness of water using EDTA.

II) ORGANIC MIXTURE

a) Identification of components in a two component mixture and preparation of their derivatives.

b) Determination of b.p. / m.p. for components and m.p. for the derivatives.

Experiment	40 Marks
Practical Viva	10 Marks
Record	10 Marks
Total	60Marks

RECOMMENDED BOOKS

1. Jeffery G H, Bassett J, Mendham J and Denney R C, Vogel's Textbook of Quantitative Chemical Analysis, 5th Ed., Longman Scientific & Technical, Essex, 1989.