V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

PEOs, POs, PSOs and COs

M.Sc. CHEMISTRY

Programme Educational Objectives (PEOs)

PEOs are broad statements that describe the career and professional achievements that the Programme is preparing the graduates to achieve within the first few years after graduation. PEOs are framed for each Programme and should be consistent with the Mission of the Institution.

Programme Outcomes (POs)

POs shall be based on Graduate Attributes (GAs) of the Programme. The GAs are the attributes expected of a graduate from a Programme in terms of knowledge, skills, attitude and values. The Graduate Attributes include Disciplinary Knowledge, Communication Skills, Critical Thinking, Problem Solving, Analytical Reasoning, Research Related Skills, Co-operation/Team Work, Scientific Reasoning, Reflective Thinking, Information/Digital Literacy, Multicultural Competence, Moral and Ethical Awareness/Reasoning, Leadership Qualities and Lifelong Learning.

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

1 Apply their in depth domain knowledge and practical skills in interdisciplinary fields for research-based endeavours, employment and entrepreneurship development. (*Disciplinary Knowledge)*

2 Communicate proficiently and confidently with the ability to present complex ideas in a concise manner to assorted groups. (*Communication Skills*)

3 Identify, formulate and solve problems in a consistent and systematic way with updated skills using modern tools and techniques. (*Scientific Reasoning and Problem Solving*)

4 Analyze the data, synthesise the findings and provide valid conclusion by critical evaluation of theories, policies and practices for the betterment of society. (*Critical Thinking and Analytical Reasoning*)

5 Explore and evaluate globally competent research methodologies to apply appropriately in interdisciplinary research; Develop and sustain the research capabilities to meet the emerging needs for the welfare of the society. (*Research Related Skills*)

6 Use ICT to mould themselves for lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning*)

7 Self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence*)

8 Uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness*)

Programme Educational Objectives (PEOs)

The students will be able to

- To educate and guide the students in attaining significant opportunities in various service domains at national and international level, and can work as scientist, analyst, quality controller, academics, research organizations and set testing labs.
- To mould the overall personality of the students by providing training and opportunities to enhance their communication skills, team management, co-ordination skills and leadership qualities.
- To guide and create awareness among the students to learn and adopt new skills and techniques to overcome the problem related with new technologies and to formulate, investigate and analyze scientifically real life problems along with ethical attitude which works in multidisciplinary team.

Key Components of the Mission Statement	PEO1	PEO2	PEO3
advanced knowledge and practical experience	√	-	√
development of research activities among students	√	√	√
employable skills for job opportunities	√	√	√
Contributing innovation of new applications of research in chemistry	√	-	√

Programme Specific Outcomes (PSOs)

Based on the Programme Outcomes, Programme Specific Outcomes are framed for each PG Programme**.** Programme Specific Outcomes denote what the students would be able to do at the time of graduation. They are Programme-specific and it is mandatory that each PO should be mapped to the respective PSO.

On successful completion of M.Sc. Programme, the students will be able to

PO 1: *Disciplinary Knowledge*

PSO 1.a : Apply in - depth knowledge on advanced concepts in Organic, Inorganic, Physical, Analytical, Biological, Environmental and Industrial applications of chemistry in research based endeavours.

PSO 1.b : Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PO 2: *Communication Skills*

PSO 2 : Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large; comprehend and write reports, documents, make effective presentation by oral and/or written form.

PO 3: *Scientific Reasoning and Problem Solving*

PSO 3.a : Develop analytical, technical and problem solving skills to handle the corrosive, poisonous, explosive and carcinogenic chemicals making themselves employable in any kind of chemical industries. Train about the adverse effects of the abnoxious chemicals and the first aid treatment.

PSO 3.b : Use modern chemical tools, Models, Chemdraw, Charts and Advanced Equipments for the potential uses in analytical industrial chemistry, medicinal chemistry and green chemistry.

PO 4: *Critical Thinking and Analytical Reasoning*

PSO 4 : Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions to create an awareness of the impact of chemistry on the environment and society.

PO 5: *Research Related Skills*

PSO 5 : Come out with clear idea of choosing original research problems, writing new projects and publishing research papers to open up new methods for environmental protection, resource management, public health and safety.

PO 6: *Digital Literacy, Self - Directed and Lifelong Learning*

PSO 6 : Use ICT tools for literature survey of the topic of research, manuscript preparation and online submission for publication. Apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and equip the students to face the employment challenges and instill confidence to turn into entrepreneur.

PO 7: *Co-operation/Team Work and Multicultural Competence*

PSO 7 : Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues.

PO 8: *Moral and Ethical Awareness*

PSO 8 : Explore the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

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Semester I	**INTRODUCTION TO ORGANIC REACTIONS**	**Hours/Week: 6**	
Core Course-1		**Credits: 4**	
Course Code 20PCHC11		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: explain electron displacement effects in covalent molecules, energy profile diagram, configuration, aromatic character and basic concepts of UV, IR and mass spectroscopy. [K2]

CO2: interpret the methods of determination of reaction mechanism, the effect of structure and configuration on reactivity of organic compounds and their spectral values and the chemistry of novel ring systems. [K3]

CO3: scrutinize the addition compounds, kinetic and thermodynamic requirements for reaction, erythro and threoisomers, aromatic sextet in different ring systems and the pattern of fragmentation in mass spectrum [K4]

CO4: analyze the significance of Hammett equation, stability of reaction intermediates, relationship between symmetry and chirality of stereoisomers, distinction between alternant and non alternant hydrocarbons and the applications of UV and IR spectroscopy. [K4]

CO5: categorize the polarization effects, mechanistic information obtained from kinetic and non- kinetic studies, stereoisomers, aromatic and non-aromatic behavior of organic compounds and the results of UV, IR and mass spectrum. [K5]

Course Code 20PCHC11	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	H	H	H	M	M	H	M
CO2	H	H	M	M	M	H	M	L	H	M
CO3	H	H	M	M	M	H	M	L	H	M
CO4	H	H	M	M	M	H	M	M	H	M
CO5	H	H	M	H	H	H	M	H	H	M

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Semester I	**CHEMICAL BONDING, SOLID STATE AND BIOINORGANIC CHEMISTRY**	**Hours/Week: 6**	
Core Course-2		**Credits: 5**	
Course Code 20PCHC12		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: understand the concepts of bonding, electronic structure of atoms, solid state, bioinorganic ,photo electron and Mossbauer spectroscopy. [K2]

CO2: illustratethe nature of chemical bonds, bond properties and electrostatic interactions. [K3]

CO3: predict the binding energy, stoichiometric defects of crystals and functions of metal in oxidases. [K3]

CO4: analyse the structure and bonding of molecules, conducting ability of solids, low spin and high spin complexes using Mossbauer Spectroscopy and XPES. [K4]

CO5: evaluate the importance and basic idea about the chemical bonding, solid state and bioinorganic chemistry, PES and Mossbauer Spectroscopy. [K5]

Course Code 20PCHC12	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	M	M	H	H
CO3	H	H	M	M	H	H	H	M	H	M
CO4	H	H	M	M	H	H	M	M	M	M
CO5	H	H	M	H	M	M	H	M	H	M

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Semester I	**QUANTUM MECHANICS AND THERMODYNAMICS**	**Hours/Week: 6**	
Core Course-3		**Credits: 5**	
Course Code 20PCHC13		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: explain the theory and concepts of Quantum mechanics and thermodynamics. [K2]

CO2: apply the knowledge of quantum mechanics to simple systems and illustrate the concepts of thermodynamics. [K3]

CO3: interpret advance knowledge on chemical thermodynamics and quantum mechanics and employ the chemistry of phase rule. [K3]

CO4: calculate approximation methods in Quantum mechanics and derive thermodynamic relations. [K4]

CO5: assess the relation between the thermodynamic and electrochemical parameters and evaluate the theorems in quantum mechanics. [K5]

Course Code 20PCHC13	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	M	H	H	H	M	M	L
CO2	H	H	H	M	H	H	H	M	M	L
CO3	H	H	H	M	H	H	H	M	M	L
CO4	H	H	H	M	H	H	H	M	M	L
CO5	H	H	H	M	H	H	H	M	M	L

Semester I	**Organic Qualitative and Quantitative Analyses**	**Hours/Week: 6**	
CorePractical-1		**Credits: 3**	
Course Code 20PCHC11P		**Internal** 40	**External** 60

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: Separate the organic mixture by chemical methods. Detect the elements (other than C, H, and O) present in a given organic compound. [K3]

CO2: Identify the functional groups in a given organic compound. Prepare the derivatives for the given organic compound. [K3]

CO3: Estimate the amount of glucose by adopting different procedures and estimate amino acid viz., Glycine. [K3]

CO4: Examine the amount of Ketonic compound and compare the amount present with the standard solution. [K4]

CO5: Categorize the given mixtures by using chromatographic techniques. [K4]

Course Code 20PCHC11P	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	H	M	H	H	M	M	H
CO2	H	H	H	H	M	H	H	M	M	H
CO3	H	H	H	H	M	H	H	M	M	H
CO4	H	H	H	H	M	H	H	M	M	H
CO5	H	H	H	H	M	H	H	M	M	H

Semester I	**MEDICINAL AND PHARMACEUTICAL CHEMISTRY**	**Hours/Week: 6**	
DSEC – 1		**Credits: 5**	
Course Code 20PCHE11		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: understand the basic knowledge on Pharmaceutical chemistry. [K2]

CO2: predict the structural features, synthesis and therapeutic action of antibiotics, thyroid hormones, antimalarial, antitubercular drugs. [K3]

CO3: predict the structural features, synthesis and therapeutic action of antitubercular, antineoplastic, anti-inflammatory, antihypertensive and CNS drugs. [K3]

CO4: interpret basic knowledge on bioinformatics in computer aided drug design analyse the synthesis and therapeutic action of chemotherapeutic agents. [K4]

CO5: evaluate the concept of Quantitative Structure Activity Relationship and Molecular docking. [K5]

Course Code 20PCHE11	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	L	H	H	M	H	M	M	M
CO2	H	M	L	H	H	M	H	M	M	M
CO3	H	M	L	H	H	M	H	M	M	H
CO4	H	M	L	H	H	M	H	H	M	H
CO5	H	M	L	H	H	M	H	H	M	H

Semester I	**COMPUTERS IN CHEMISTRY**	**Hours/Week: 6**	
DSEC – 1		**Credits: 5**	
Course Code 20PCHE12		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: understand the basic concepts of visual basics. [K2]

CO2: write the different language forms. [K3]

CO3: operate internet protocols, email and to apply database in chemistry. [K3]

CO4: infer the application of C language in chemistry. [K4]

CO5: evaluate the basic concepts of communication system. [K5]

Course Code 20PCHE12	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO5	PSO 6	PSO 7	PSO 8
CO1	H	M	L	M	H	M	H	H	H	M
CO2	H	M	L	M	H	M	H	H	H	M
CO3	H	M	L	M	H	M	H	H	H	M
CO4	H	M	L	M	H	M	H	H	H	M
CO5	H	M	L	M	H	M	H	H	H	M

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Semester I	**DYE CHEMISTRY**	**Hours/Week: 6**	
DSEC – 1		**Credits: 5**	
Course Code 20PCHE13		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: understand the basic concepts of colour and chemical constitution of dyes. [K2]

CO2: demonstrate the mechanism of dyeing. [K3]

CO3: predict the nature and applications of vat, mordant and azo dyes. [K3]

CO4: infer the chemistry involved in the production of dyes. [K4]

CO5: evaluate the theory behind the colour and brightening of dyes. [K5]

Course Code 20PCHE13	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	L	M	H	M	H	L	L	M
CO2	H	M	L	M	H	M	H	L	L	M
CO3	H	M	L	M	H	M	H	L	L	M
CO4	H	M	L	M	H	M	H	L	L	M
CO5	H	M	L	M	H	M	H	L	L	M

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Semester II	**STEREOCHEMISTRY AND REACTION MECHANISM**	**Hours/Week: 6**	
Core Course-4		**Credits: 4**	
Course Code 20PCHC21		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: describe prochirality and prostereoisomerism, the conformations of acyclic and cyclic systems and the basic concepts of substitution, addition and eliminaton reactions. [K2]

CO2: predict the nomenclature of prostereoisomers, interpret Cram and Prelog rules, Curtin – Hammett principle, neighbouring group participation of n, π and σ electrons and the stereochemical factors in substitution, addition and elimination reactions. [K3]

CO3: analyse the enantiotopic and diastereotopic ligands and faces, conformations of cyclohexanones, aldohexopyranoses and decal in and the mechanisms involved in substitution, addition and elimination reactions. [K4]

CO4: correlate the optical isomerism in molecules with no chiral centers, conformations of acyclic and cyclic systems with their physical and chemical properties nucleophilicity and basicity, electrophilic, nucleophilic and free radical additions and aromatic electrophilic and nucleophilic substitution reactions. [K4]

CO5: categorize nucleophilic substitution at various carbon centers, electrophilic, nucleophilic and free radical additions to multiple bonds, α - elimination, β – elimination and pyrolyticcis elimination reactions and stereospecific and stereoselective reactions[K5]

Course Code 20PCHC21	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO1	**H**	**H**	**L**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO2	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO3	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO4	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO5	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**

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Semester II	**STEREOCHEMISTRY AND REACTION MECHANISM**	**Hours/Week: 6**	
Core Course-4		**Credits: 4**	
Course Code 20PCHC21N		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: describe prochirality and prostereoisomerism, the conformations of acyclic and Cyclic systems and the basic concepts of substitution, addition and elimination reactions. [K2]

CO2: predict the nomenclature of prostereoisomers; interpret Cram and Prelog rules, Curtin - Hammett principle, neighboring group participation of n, π and σ electrons and the stereochemical factors in substitution, addition and elimination reactions. [K3]

CO3: analyse the enantiotopic and diastereotopic ligands and faces, conformations of cyclohexanones, aldohexopyranoses and decalin and the mechanisms involved in substitution, addition and elimination reactions. [K4]

CO4: correlate the optical isomerism in molecules with no chiral centers, Conformations of acyclic and cyclic systems with their physical and chemical properties, nucleophilicity and basicity, electrophilic, nucleophilic and free radical additions and aromatic electrophilic and nucleophilic substitution reactions. [K4]

CO5: categorize nucleophilic substitution at various carbon centers, electrophilic, nucleophilic and free radical additions to multiple bonds, α - elimination, β – elimination and pyrolytic cis elimination reactions and stereospecific and stereoselective reactions. [K5]

Course Code 20PCHC21N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**H**	**L**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO 2	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO 3	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO 4	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**
CO 5	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**M**

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Semester II	**COORDINATION CHEMISTRY AND F-BLOCK ELEMENTS**	**Hours/Week: 6**	
Core Course-5		**Credits: 5**	
Course Code 20PCHC22		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: understand the concepts involved in coordination compounds, polyacids, silicates,inorganic chains, rings, cages,f-block elements, photochemistry and electronic spectroscopy. [K2]

CO2: predict the splitting pattern, stability and reactivity of co-ordination compounds, structure and bonding for inorganic compounds, properties and separation techniques in f-block elements, types of electronic transition and reactivity of complexes in photochemistry. [K3]

CO3: apply LFT,CFT, MOT, Orgel, Tanabe – Sugano diagram and photo redox and substitution reactions for metal complexes, different techniques to identify the stability and reactivity of complexes, structure and bonding to identify the inorganic compounds, extraction techniques, spectral and magnetic behavior of f- block elements and. [K3]

CO4: analyze the structure, stability and reactivity of coordination and inorganic compounds, chemistry of f-block elements,Ru(II), Co(III) and Cr(III) complexes and different transitions involved in electronic spectrum. [K4]

CO5: evaluate the structure, stability and reactivity of coordination and inorganic compounds, separation and characterization of f-block elements, electronic absorption spectrum of novel compounds and d-d transition in Ru(II), Co(III) and Cr(III) complexes. [K5]

Course Code 20PCHC22	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	H	H	H	M	H	H	H	M
CO2	H	H	M	H	H	H	H	H	H	M
CO3	H	H	M	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	H	M	H	M
CO5	H	H	H	H	H	H	H	M	H	M

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Semester II	**COORDINATION CHEMISTRY AND F-BLOCK ELEMENTS**	**Hours/Week: 6**	
Core Course-5		**Credits: 5**	
Course Code 20PCHC22N		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: understand the concepts involved in coordination compounds, polyacids, silicates, inorganic chains, rings, cages, f-block elements and electronic spectroscopy. [K2]

CO2: predict the splitting pattern, stability and reactivity of co-ordination compounds, structure and bonding for inorganic compounds, properties and separation techniques in f-block elements, inorganic chains, rings, cages types of electronic transition. [K3]

CO3: apply LFT,CFT, MOT, Orgel, Tanabe – Sugano diagram, different techniques to identify the stability and reactivity of complexes, structure and bonding to identify the inorganic compounds, inorganic chains, rings, cages extraction techniques, spectral and magnetic behavior of f- block elements and [K3]

CO4: analyze the structure, stability and reactivity of coordination and inorganic compounds, chemistry of f-block elements, inorganic chains, rings, cages and different transitions involved in electronic spectrum.[K4]

CO5: evaluate the structure, stability and reactivity of coordination and inorganic compounds, separation and characterization of f-block elements, inorganic chains, rings, cages electronic absorption spectrum of novel compounds. [K5]

Course Code	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
20PCHC22N	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**H**	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**M**
CO 2	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**	**M**
CO 3	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**M**	**H**	**M**
CO 4	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**H**	**M**
CO 5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**H**	**M**

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Semester II	**GROUP THEORY, STATISTICAL THERMODYNAMICS AND MACROMOLECULAR CHEMISTRY**	**Hours/Week: 6**	
Core Course-6		**Credits: 5**	
Course Code 20PCHC23		**Internal** 40	**External** 60

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: discuss the basic concepts of Group theory, statistical and non equilibrium thermodynamics. [K2]

CO2: predict ensemble averaging , thermodynamic properties of partition functions, heat capacity behavior of solids, entropy production and types and properties of polymers. [K3]

CO3: apply the concepts of Group theory to spectroscopy and predict Huckel molecular orbital theory. [K3]

CO4: calculate kinetics and mechanism for synthesis of macromolecules and develop procedure for molecular weight determination of macromolecules, construct the character Tables using Great Orthogonality theorem and identify relation of irreversible thermodynamics with biological systems. [K4]

CO5: develop applications of HMO theory, Onsager's reciprocal theory, partition functions and new polymers in material science. [K5]

Course Code 20PCHC23	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	H	H	H	H	M	H	L
CO2	H	M	H	H	H	H	H	M	H	L
CO3	H	M	H	H	H	H	H	H	H	L
CO4	H	M	H	H	H	H	H	H	H	L
CO5	H	M	H	H	H	H	H	H	H	L

Semester II	**GROUP THEORY, STATISTICAL AND NON-EQUILIBRIUM THERMODYNAMICS**	**Hours/Week: 6**	
Core Course-6		**Credits: 5**	
Course Code 20PCHC23N		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: discuss the basic concepts of Group theory, statistical and non equilibrium thermodynamics. [K2]

CO2: predict ensemble averaging , thermodynamic properties of partition functions, heat capacity behavior of solids, entropy production and types and linear laws of non-equilibrium thermodynamics.. [K3]

CO3: apply the concepts of Group theory to spectroscopy and predict Huckel molecular orbital theory and statistical & non-equilibrium thermodynamics [K3]

CO4: construct the character Tables using Great Orthogonality theorem and identify relation of irreversible thermodynamics with biological systems. [K4]

CO5: develop applications of HMO theory, Onsager's reciprocal theory, partition functions and statistical & non-equilibrium thermodynamics. [K5]

Course Code 20PCHC23N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**M**	**H**	**M**
CO 2	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**M**	**H**	**M**
CO 3	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**
CO 4	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**
CO 5	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**

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Semester II	**Inorganic Qualitative Analysis and Complexometric Titrations with EDTA**	**Hours/Week: 6**	
CorePractical-2		**Credits: 3**	
Course Code 20PCHC21P		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, the students shall be able to

CO1: apply systematic procedure and find out the familiar cations present in the given mixture of salts. [K3]

CO2: apply systematic procedure and find out the less familiar cations present in the given salt mixture.[K3]

CO3: calculate the amount of Nickel ions present in the given solution by direct and indirect EDTA volumetric methods. [K3]

CO4: examine the amount of metal ions such as like Zinc, Magnesium and Copper present in the given solution by EDTA volumetric method ad compare the result with the standard solution. [K4]

CO5: develop the laboratory skill to deduct any unknown metal ions both by quantitative and qualitative analysis. [K5]

Course Code 20PCHC21P	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	H	H	H	H	M	H	M
CO2	H	M	H	H	H	H	H	M	H	M
CO3	H	M	H	H	H	H	H	M	H	M
CO4	H	M	H	H	H	H	H	M	H	M
CO5	H	M	H	H	H	H	H	M	H	M

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Semester II	**ANALYTICAL CHEMISTRY**	**Hours/Week: 6**	
Discipline Specific Elective Course-2		**Credits: 5**	
Course Code 20PCHE21		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: understand the properties of precipitates, error analysis, types of electrodes, thermoanalytical and spectroanalytical methods. [K2]

CO2: illustrate the methods of precipitation, statistical treatment of data, theory of electro analytical methods, principles of TGA, DSC, DTA, nephelometry, turbidimetry and flame spectrometry. [K3]

CO3: interpret the calibration of instruments, different types of precipitations, reliability of results, and instrumentation of electroanalytical techniques, thermoanalytical methods, colorimetric and spectrophotometric analysis of elements. [K3]

CO4: analyze the co-precipitation, post-precipitation, gravimetric analysis, error and statistical data, means of the two samples, determination of ions by electroanalytical methods, thermal behavior of various compounds and determination of metals by spectroanalytical methods. [K4]

CO5: summarize the steps involved in gravimetric analysis, calibration of instruments, classification of errors, comparison of results, comparison of means of two samples and principle, instrumentation, applications of electroanalytical, thermoanalytical methods, and spectroanalytical methods for project. [K5]

Course Code 20PCHE21	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	L	H	H	H	H	M	M	L
CO2	H	H	L	H	H	H	H	M	M	L
CO3	H	H	L	H	H	H	H	M	M	L
CO4	H	H	L	H	H	H	H	M	M	L
CO5	H	H	L	H	H	H	H	M	M	L

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Semester II	**ANALYTICAL CHEMISTRY**	**Hours/Week: 6**	
Discipline Specific Elective Course-2		**Credits: 5**	
Course Code 20PCHE21N		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: Understand the concepts of error analysis, types of electrodes, thermoanalytical, electroanalytical, morphological techniques and spectroanalytical methods.[K2]

CO2: Illustrate statistical treatment of data, theory of electro analytical methods, principles of TGA, DSC, DTA, nephelometry, turbidimetry and flame spectrometry.[K3]

CO3: Interpret the calibration of instruments, reliability of results, and instrumentation of electroanalytical techniques, thermoanalytical methods, colorimetric and spectrophotometric analysis of elements.[K3]

CO4: Analyze error and statistical data, means of the two samples, determination of ions by electroanalytical methods, thermal behavior of various compounds and analysis by spectroanalytical, thermoanalytical, morphological techniques.[K4]

CO5: Summarize calibration of instruments, classification of errors, comparison of results, comparison of means of two samples and principle, instrumentation, applications of electroanalytical, thermoanalytical methods, morphological techniques and spectroanalytical methods for project. [K5]

Course Code 20PCHE21N	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO3. a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO 1	H	H	L	H	H	H	H	M	M	L
CO 2	H	H	L	H	H	H	H	M	M	L
CO 3	H	H	L	H	H	H	H	M	M	L
CO 4	H	H	L	H	H	H	H	M	M	L
CO 5	H	H	L	H	H	H	H	M	M	L

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Semester II	**POLYMER CHEMISTRY**	**Hours/Week: 6**	
Discipline Specific Elective Course-2		**Credits: 5**	
Course Code 20PCHE22		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: understand the classification of polymers. [K2]

CO2: discuss the kinetics of polymerization techniques. [K2]

CO3: illustrate the preparation of individual polymers. [K3]

CO4: outline the properties of polymers and various techniques for processing polymers. [K4]

CO5: evaluate the polymerization techniques, degradation and uses of polymers. [K5]

Course Code 20PCHE22	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	L	H	H	H	H	M	M	M
CO2	H	H	L	H	H	H	H	M	M	M
CO3	H	H	L	H	H	H	H	M	M	M
CO4	H	H	L	H	H	H	H	M	M	M
CO5	H	H	L	H	H	H	H	M	M	M

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Semester II	**INDUSTRIAL CHEMISTRY**	**Hours/Week: 6**	
Discipline Specific Elective Course-2		**Credits: 5**	
Course Code 20PCHE23		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: understand the chemical concepts involved in dairy, leather and polymer products; chemistry involved in paint, pigments, energy resources and biofuels. [K2]

CO2: acquire knowledge about the manufacturing processes of industrial products. [K2]

CO3: analyse purity of industrial products. [K3]

CO4: apply the concept to harvest more energy from the natural resources and produce quality products. [K4]

CO5: prepare the novel industrial products. [K5]

Course Code 20PCHE23	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	L	H	H	H	H	M	M	M
CO2	H	H	L	H	H	H	H	M	M	M
CO3	H	H	L	H	H	H	H	M	M	M
CO4	H	H	L	H	H	H	H	M	M	M
CO5	H	H	L	H	H	H	H	M	M	M

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Semester III	**ORGANIC SPECTROSCOPY, REARRANGEMENT, REAGENTS AND SYNTHETIC METHODS**	**Hours/Week: 6**	
Core Course-7		**Credits: 4**	
Course Code 20PCHC31		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO 1: precise the basic concepts of NMR Spectroscopy, pericyclic reactions, Oxidation and Reduction reactions, Rearrangements and Retrosynthetic analysis. [K2]

CO 2: interpret the concepts of NMR to assign and ascertain the types of protons and carbon frame work in organic compounds, mechanism of reactions and the usage of activating and blocking groups in synthesis. [K3]

CO 3: identify ^{1}H NMR and ^{13}C NMR spectrum, the different approaches in pericyclic reactions, intermolecular and intramolecular mechanisms in rearrangements, the pathway of catalytic oxidation and reduction reactions and relay and convergent approaches to total synthesis. [K3]

CO4: examine correlation spectrums and categorize photochemical reactions, molecular rearrangements, reagents in organic synthesis, stereoselective problems of geometrical and optical isomerism in planning a synthesis. [K4]

CO 5: predict the factors affecting ^{1}H NMR and ^{13}C NMR, thestereochemical aspects of oxidation,reduction reactionsand rearrangements, novel synthetic strategies in organic chemistry and justify the conservation of orbital symmetry in pericyclic reactions. [K5]

Course Code 20PCHC31	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO3 a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	H	M	H	H	H	H	M	M
CO2	H	H	M	M	M	L	M	L	M	M
CO3	H	H	M	M	M	M	M	M	M	H
CO4	H	H	M	M	M	M	L	L	L	H
CO5	H	H	M	M	M	H	M	H	M	H

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Semester III	**ORGANIC SYNTHESIS AND SPECTROSCOPY**	**Hours/Week: 6**	
Core Course-7		**Credits: 4**	
Course Code 20PCHC31N		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO 1: precise the basic concepts of NMR Spectroscopy, pericyclic reactions, Oxidation and Reduction reactions, Rearrangements and Retrosynthetic analysis.[K2]

CO 2: interpret the concepts of NMR to assign and ascertain the types of protons and carbon frame work in organic compounds, mechanism of reactions and the usage of activating and blocking groups in synthesis [K3}

CO 3: identify ^{1}H NMR and ^{13}C NMR spectrum, the different approaches in pericyclic reactions, intermolecular and intramolecular mechanisms in rearrangements, the pathway of catalytic oxidation and reduction reactions and relay and convergent approaches to total synthesis [K3]

CO4: examine correlation spectrums and categorize photochemical reactions, molecular rearrangements, reagents in organic synthesis, stereoselective problems of geometrical and optical isomerism in planning a synthesis. [K4]

CO 5: predict the factors affecting ^{1}H NMR and ^{13}C NMR, thestereochemical aspects of oxidation, reduction reactions and rearrangements, novel synthetic strategies in organic chemistry and justify the conservation of orbital symmetry in pericyclic reactions. [K5]

Course Code 20PCHC31N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO3a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**M**	**M**
CO 2	**H**	**H**	**M**	**M**	**M**	**L**	**M**	**L**	**M**	**M**
CO 3	**H**	**H**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**H**
CO 4	**H**	**H**	**M**	**M**	**M**	**M**	**L**	**L**	**L**	**H**
CO 5	**H**	**H**	**M**	**M**	**M**	**H**	**M**	**H**	**M**	**H**

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Semester III	**ORGANOMETALLICS, NUCLEAR CHEMISTRY AND INORGANIC SPECTROSCOPY**	**Hours/Week: 6**	
Core Course - 8		**Credits: 5**	
Course Code 20PCHC32		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: understand the principle of spectroscopic techniques, nuclear and organometallic chemistry [K2].

CO2: predict the nomenclature, stability, synthesis, structure, bonding, isolobal, isoelecronicity and catalytic behavior of organometallic compounds, nuclear reaction, forces, detectors, accelerators ,application of radioactive substances, various compounds using spectroscopy techniques. [K3]

CO3: apply the organometallic chemistry to synthesize industrial chemical reactions, nuclear chemistry to predict the radioactive substances and spectroscopic technique to study the structure of compounds. [K3].

CO4: examine the stability, structure, bonding, synthesis and reactivity of organometalliccompounds, isotopes, nuclear reaction and reactor and applications of EPR, NMR & NQR. [K4]

CO 5: interpret the synthetic method, bonding, structural elucidation, stability and catalyticefficiency of organometallic compounds and spectral data. [K5]

Course Code 20PCHC32	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	H	H	M	H	H	M	M
CO2	H	H	M	H	H	M	H	H	M	M
CO3	H	H	L	H	H	M	H	H	L	M
CO4	H	H	L	H	H	M	H	H	L	M
CO5	H	H	M	H	H	M	H	H	M	M

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Semester III	**ORGANOMETALLICS, INORGANIC PHOTOCHEMISTRY AND SPECTROSCOPY**	**Hours/Week: 6**	
Core Course - 8		**Credits: 5**	
Course Code 20PCHC32N		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: understand the principle of spectroscopic techniques, photochemistry and organometallic chemistry [K2].

CO2: predict the nomenclature, stability, synthesis, structure, bonding, iso lobal, isoelecronicity and catalytic behavior of organometallic compounds, inorganic phototchemistry and various compounds using spectroscopy techniques. [K3]

CO3: apply the organometallic chemistry to synthesize industrial chemical reactions , Photochemical Unimolecular reactions and spectroscopic technique to study the structure of compounds.[K3].

CO4: examine the stability, structure, bonding, synthesis and reactivity of Organometallic compounds, photochemical reactions of inorganic compounds and applications of EPR, NMR & NQR. [K4]

CO 5: interpret the synthetic method, bonding, structural elucidation, stability and Catalytic efficiency of organometallic compounds, inorganic photochemical aspects and spectral data. [K5].

Course Code 20PCHC32N	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO 1	H	H	M	H	H	M	H	H	M	M
CO 2	H	H	M	H	H	M	H	H	M	M
CO 3	H	H	L	H	H	M	H	H	L	M
CO 4	H	H	L	H	H	M	H	H	L	M
CO 5	H	H	M	H	H	M	H	H	M	M

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Semester III	**ELECTROCHEMISTRY AND MOLECULAR SPECTROSCOPY**	**Hours/Week: 6**	
Core Course – 9		**Credits: 5**	
Course Code 20PCHC33		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: summarise the fundamental concepts and theories of electrochemistry and molecular microwave, vibrational and electronic spectroscopy. [K2]

CO2: make use of the applications of electrochemistry and molecular spectroscopy. [K3]

CO3: outline the concepts of electrolytic conductance, electrokinetic phenomena and spectroscopic techniques such as elelctronic and microwave. [K3]

CO4: analyze the physical approach of Debye-Huckel theory and microwave, IR & Raman spectra. [K4]

CO5: evaluate the theory and applications of Butler-Volmer and Tafel equations and ESR, NMR and NQR spectroscopic techniques. [K5]

Course Code 20PCHC33	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	H	H	H	H	M	M	M	M
CO2	H	H	H	H	H	H	M	M	M	M
CO3	H	H	H	H	H	H	M	M	M	H
CO4	H	H	H	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	M	M	M	H

Semester III	**ELECTROCHEMISTRY AND MOLECULAR SPECTROSCOPY**	**Hours/Week: 6**	
Core Course – 9		**Credits: 5**	
Course Code 20PCHC33N		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: Summarise the fundamental concepts and theories of electrochemistry and molecular microwave, vibrational and electronic spectroscopy. [K2]

CO2: Make use of the applications of electrochemistry and molecular spectroscopy. [K3]

CO3: Outline the concepts of electrolytic conductance, electrokinetic phenomena and spectroscopic techniques such as elelctronic and microwave. [K3]

CO4: analyze the physical approach of Debye-Huckel theory and microwave, IR & Raman spectra. [K4]

CO5: evaluate the theory and applications of Butler-Volmer and Tafel equations and molecular spectroscopic techniques. [K5]

Course Code 20PCHC33N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO 2	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO 3	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 4	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 5	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**

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Semester III	**PHYSICAL CHEMISTRY EXPERIMENTS**	**Hours/Week: 6**	
Core Practical -3		**Credits: 3**	
Course Code 20PCHC31P		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: apply standard procedure to carryout the various types of conductometric titrations. [K3]

CO2: apply standard procedure to carryout the various types of potentiometric titrations. [K3]

CO3: develop analytical skill to perform adsorption experiments. [K3]

CO4: examine the metal ions such as Cu^{2+}, Fe^{2+} and Ni^{2+} ions by spectrophotometric techniques. and compare their strengths with the standard solution. [K4]

CO5: interpret the spectral results obtained of the unknown compounds by using pHmeter, UV-Vis and IR specrophotometric techniques. [K5]

Course Code 20PCHC31P	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	H	H	H	H	M	M	M	M
CO2	H	H	H	H	H	H	M	M	M	M
CO3	H	H	H	H	H	H	M	M	M	M
CO4	H	H	H	H	H	H	M	M	M	M
CO5	H	H	H	H	H	H	M	M	M	M

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Semester III	**CHEMISTRY FOR COMPETTIVE EXAMINATION**	**Hours/Week: 5**	
NMEC		**Credits: 4**	
Course Code 20PCHN31		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: know the fundamentals of chemistry. [K1]

CO2: understand the basics of chemistry like elements, symbols, important laws and chemical process in chemistry, concepts of acid and bases, water and their types, environmental chemistry, nuclear chemistry, and chemistry in service of man. [K2]

CO3: identify the types of chemical reactions, water, solutions, chemical processes, environmental pollutions, nature of metals, chemical formulae, symbol of atoms, polymers, cement, lubricants, soaps, fuels, corrosion, food adulterants, antibiotics, vitamins, and concepts of acids and bases. [K3]

CO4: analyze the rudiment in chemistry, environmental pollutions, and chemistry in service of man. [K4]

CO5: interpret important basic terms, concepts, laws, chemical processes, environmental chemistry, and chemistry in service of man. [K5]

Course Code 20PCHN31	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO3	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO4	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO5	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**

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Semester III	**CHEMISTRY FOR COMPETITVE EXAMINATION**	**Hours/Week: 6**	
NMEC		**Credits: 4**	
Course Code 20PCHN31N		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: know the fundamentals of chemistry. [K1]

CO2: understand the basics of chemistry like elements, symbols, important laws and chemical process in chemistry, concepts of acid and bases, water and their types, environmental chemistry, nuclear chemistry, and chemistry in service of man. [K2]

CO3: identify the types of chemical reactions, water, solutions, chemical processes, environmental pollutions, nature of metals, chemical formulae, symbol of atoms, polymers, cement, lubricants, soaps, fuels, corrosion, food adulterants, antibiotics, vitamins, and concepts of acids and bases. [K3]

CO4: analyze the rudiment in chemistry, environmental pollutions, and chemistry in service of man. [K4]

CO5: interpret important basic terms, concepts, laws, chemical processes, environmental chemistry, and chemistry in service of man. [K5]

Course Code 20PCHN31N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO4	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**

Semester III	**PRACTICE FOR CSIR / NET – GENERAL PAPER**	**Hours/Week:1**	
Course Code		**Credits: 1**	
20PGOL32		**Internal 100**	**External -**

COURSE OUTCOMES

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

CO1 : explian various concepts related to numbers, quantitative comparison, monetary problems and logical reasoning. [K2]

CO2 : apply the analytical skills and logical reasoning in solving problems related to competitive examinations. [K3]

CO3 : solve typical problems, geometrical type problems, daily life problems in a effective manner. [K3]

CO4 : analyze the techniques used in solving complicated real life problems.[K4]

CO5 : interpret the data using logical reasoning and observational ability.[K5]

Course Code 20PGOL32	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	**H**	**H**	**M**	**M**	**-**	**M**	**-**	**-**
CO2	**H**	**H**	**H**	**H**	**-**	**M**	**-**	**-**
CO3	**H**	**H**	**H**	**H**	**-**	**H**	**-**	**-**
CO4	**H**	**M**	**H**	**H**	**-**	**H**	**-**	**-**
CO5	**H**	**M**	**H**	**H**	**-**	**H**	**-**	**-**

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Semester IV	**HETEROCYCLES , NATURAL PRODUCTS AND ANALYTICAL TECHNIQUES**	**Hours/Week: 6**	
Core Course-10		**Credits: 5**	
Course Code 20PCHC41		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: comprehend the structural and synthetic aspects of biomolecules, heterocycles and natural products and describe the analytical techniques. [K2]

CO2: predict the ring size in carbohydrates, elucidate the structure of natural products, sketch the preparation of heterocyclesand apply the Octant rule in determining the configuration and conformation of simple monocyclic and bicyclic ketones. [K3]

CO3: interpret the structure of RNA and DNA, demonstrate the synthesis of biomolecules, relate the structure and reactivity of heterocycles, natural products and practice chromatographic techniques. [K3]

CO4: analyze the synthetic routes to peptides, heterocycles, and natural products and relate CD and ORD curves. [K4]

CO5: categorize the significance of biomolecules, heterocycles and natural products in day to-day life and plan the suitable chromatographic technique for their project. [K5]

Course Code 20PCHC41	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	H	M	M	H	M	M	M	L
CO2	H	H	M	M	M	H	M	M	L	L
CO3	H	H	M	M	M	M	M	M	H	H
CO4	H	H	M	M	L	H	M	M	L	L
CO5	H	H	H	H	M	H	H	H	H	H

Semester IV	**Heterocycles, natural products and analytical techniques**	**Hours/Week: 6**	
Core Course-10		**Credits: 5**	
Course Code 20PCHC41N		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: comprehend the structural and synthetic aspects of biomolecules, heterocycles and natural products and describe the analytical techniques. [K2]

CO2: predict the ring size in carbohydrates, elucidate the structure of natural products, sketch the preparation of heterocycles and apply the Octant rule in determining the configuration and conformation of simple monocyclic and bicyclic ketones. [K3]

CO3: interpret the structure of RNA and DNA, demonstrate the synthesis of biomolecules, relate the structure and reactivity of heterocycles, natural products and practice chromatographic techniques. [K3]

CO4: analyze the synthetic routes to peptides, heterocycles, and natural products and relate CD and ORD curves. [K4]

CO5: categorize the significance of biomolecules, heterocycles and natural products in day to- day life and plan the suitable chromatographic technique for their project. [K5]

Course Code 20PCHC41N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1..b**	**PSO 2**	**PSO 3.a**	**PSO 3..b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**M**	**H**	**M**	**M**	**H**	**M**	**M**	**M**	**L**
CO 2	**H**	**H**	**M**	**M**	**M**	**H**	**M**	**M**	**L**	**L**
CO 3	**H**	**H**	**M**	**M**	**M**	**M**	**M**	**M**	**H**	**H**
CO 4	**H**	**H**	**M**	**M**	**L**	**H**	**M**	**M**	**L**	**L**
CO 5	**H**	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**

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Semester IV	**CHEMICAL KINETICS, SURFACE AND BIOPHYSICAL CHEMISTRY**	**Hours/Week: 6**	
Core Course 11		**Credits: 5**	
Course Code 20PCHC42		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: extend the fundamental concepts and theories of reaction rate in kinetics, surface and biophysical chemistry. [K2]

CO2: make use of the principle and applications of kinetics, Biophysical, surface and Supramolecular chemistry. [K3]

CO3: develop advanced knowledge of catalysis, kinetics of complex reactions, Bioenergetics, Photo and Radiation Chemistry. [K3]

CO4: analyze the concepts of the fast reactions, biomolecular techniques, self assembly in supramolecular chemistry, surface and radiation chemistry. [K4]

CO5: evaluate about complex reactions, catalysis, radiation chemistry, biomolecular study and molecular recognition. [K5]

Course Code 20PCHC42	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	H	H	H	M	M	M	L
CO2	H	M	M	H	H	H	M	M	M	L
CO3	H	M	M	H	H	H	M	M	M	H
CO4	H	M	M	H	H	H	M	M	M	H
CO5	H	M	M	H	H	H	M	M	M	H

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Semester IV	**CHEMICAL KINETICS AND CATALYSIS, PHOTO, BIOPHYSICAL AND SUPRAMOLECULARCHEMISTRY**	**Hours/Week: 6**	
Core Course 11		**Credits: 5**	
Course Code 20PCHC42N		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: extend the fundamental concepts and theories of reaction rate in kinetics, surface, photo, biophysical and supramolecular chemistry. [K2]

CO2: make use of the principle and applications of kinetics and catalysis, Biophysical, photo, surface and Supramolecular chemistry. [K3]

CO3:develop advanced knowledge of catalysis, kinetics of complex reactions, Bioenergetics, Photo, biophysical and supramolecular Chemistry. [K3]

CO4: analyze the concepts of the fast reactions, biomolecular techniques, self assembly in supramolecular chemistry, surface, biophyical and photo chemistry. [K4]

CO5:evaluate about complex reactions, catalysis, photo chemistry, biomolecular study and molecular recognition. [K5]

Course Code 20PCHC42N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**L**
CO 2	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**L**
CO 3	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 4	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 5	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**

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Semester IV	**NANO AND GREEN CHEMISTRY**	**Hours/Week: 6**	
Core Course 12		**Credits: 5**	
Course Code 20PCHC43		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: understand the basic concepts in nanochemistry and green chemistry. [K2]

CO2: apply various methods for synthesis of nano particles ,characterization nanomaterials, study of applications of nano particles,synthesis using green techniques. [K3]

CO3: apply the techniques of nano chemistry in nanoparticles synthesis, characterization, applications and green chemistry in designing the environmentally benign synthesis. [K3]

CO4: examine the different methods for synthesis of nanomaterials,Instrumentation of SEM, TEM, STM, properties of nano particles and their applications and design the synthesis of compounds by adopting principles of green chemistry. [K4]

CO5: predict the methods of synthesis of nano particles, size of nano particles,properties and applications of nanoparticles and evaluate the advantages of green synthesis. [K5]

Course Code 20PCHC43	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO1	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO2	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO3	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO4	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO5	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**

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Semester IV	**NANO AND GREEN CHEMISTRY**	**Hours/Week: 6**	
Core Course -12		**Credits: 5**	
Course Code 20PCHC43N		**Internal 40**	**External 60**

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: understand the basic concepts in nanochemistry and green chemistry. [K2]

CO2: apply various methods for synthesis of nano particles, characterization nanomaterials, study of applications of nano particles,synthesis using green techniques.[K3]

CO3: apply the techniques of nano chemistry in nanoparticles synthesis, characterization, applications and green chemistry in designing the environmentally benign synthesis. [K3]

CO4: examine the different methods for synthesis of nanomaterials, Instrumentation of SEM, TEM, STM, properties of nano particles and their applications and design the synthesis of compounds by adopting principles of green chemistry [K4]

CO5: predict the methods of synthesis of nano particles, size of nano particles,properties and applications of nanoparticles and evaluate the advantages of green synthesis.[K5]

Course Code 20PCHC43N	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO 1	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO 2	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO 3	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO 4	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**
CO 5	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**M**	**M**	**H**

Semester IV	**Inorganic Quantitative Analysis and Complex Preparation**	**Hours/Week: 6**	
Core Practical 4		**Credits: 4**	
Course Code 20PCHC41P		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: separate and estimate mixtures of metal ions by volumetric and gravimetric methods. [K3]

CO2: prepare coordination complexes such as Tristhioureacopper(II) sulphate, potassium trioxalato aluminate(III), Tetramminecopper(II) sulphate, Reineck's salt. [K3]

CO3: prepare coordination complexes such as *trans*-Potassium dioxalatodiaquachromate(III), *cis*-Potassium dioxalatodiaquachromate(III), Sodium trioxalatoferrate(III), Hexathiourealead(II) nitrate. [K3]

CO4: examine the strengths of inorganic metal ions such as nickel, barium and zinc by gravimetric methods and compare the calculated strengths with the standard solutions. [K4]

CO5: examine the strengths of inorganic metal ions such as iron(III), copper, calcium by volumetric methods and compare the calculated strengths with the standard solutions. [K5]

Course Code 20PCHC41P	**PO1**		**PO2**	**PO3**		**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	PSO 1a	**PSO 1b**	**PSO 2**	**PSO 3a**	**PSO 3b**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO1	**H**	**H**	**M**	**H**	**M**	**M**	**M**	**H**	**H**	**M**
CO2	**H**	**H**	**M**	**H**	**M**	**M**	**M**	**H**	**H**	**M**
CO3	**H**	**H**	**M**	**H**	**M**	**M**	**M**	**H**	**H**	**M**
CO4	**H**	**H**	**M**	**H**	**M**	**M**	**M**	**H**	**H**	**M**
CO5	**H**	**H**	**M**	**H**	**M**	**M**	**M**	**H**	**H**	**M**

Semester IV	**PROJECT VIVA-VOCE**	**Hours/Week: 6**	
Core Project		**Credits: 5**	
Course Code 20PCHC41PR		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: develop research methodologies along with literature survey. [K3]

CO2: categorize the synthesized materials using various analytical techniques. [K4]

CO3: interpret the analytical data and able to correlate theoretical and experimental results. [K4]

CO4: communicate the laboratory scientific results both in oral, written and electronic format to both chemists and non-chemists. [K4]

CO5: evaluate new methodologies to develop novel materials through new synthetic routes. [K5]

Course Code 20PCHC4PR	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO2	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO3	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO4	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO5	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**

Semester IV	**Project - Research Methodology & Ethics**	**Hours/Week: 6**	
Core Project		**Credits: 5**	
Course Code 22PCHC41PR		**Internal 60**	**External 40**

COURSE OUTCOMES

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

CO1: understand the fundamentals of research methodologies and develop ability to choose methods appropriate to research aims and objectives [K3]

CO2: select and define appropriate research problem [K4]

CO3: analyze various methods for collecting primary and secondary data along with literature Survey. [K4]

CO4: analyze research ethical issues related to Research and Publication. [K4]

CO5: evaluate new methodologies to develop novel materials through new synthetic routes. [K5]

Course Code 22PCHC41PR	PO1		PO2	PO3		PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO 1	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 2	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 3	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 4	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**
CO 5	**H**	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**M**	**H**