

**ST JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS)**

**VISAKHAPATNAM**

**DEPARTMENT OF CHEMISTRY**

The Department of Chemistry, St. Joseph's College for Women (A) seeks to serve BSc Programme students interested in careers related to Chemistry. The department offers chemistry in three core combinations MPC, CBZ and BBC of BSc. programme. In order to cater to the diverse interests of students and employers, a total of 14 theory and 11 practical courses are offered as part of chemistry domain in all the three combinations.

**Programme Specific Outcomes of BSc Programme with Chemistry**

**PSOs :** Students after graduating with Chemistry as one of the core subjects will:

**PSO 1:** Be able to demonstrate basic knowledge in the core areas of chemistry (analytical, general, inorganic, organic and physical, pharmaceutical, green chemistry, polymer chemistry etc).

**PSO 2:** Be versatile in classical laboratory techniques, use instrumental methods for analysis as well as synthesis and follow standardised procedures and regulations in handling and disposal of chemicals.

**PSO 3:** Be able to access, scout and use the chemical literature and also able to work as a member of a team.

**PSO 4:** Be able to integrate knowledge gained in Chemistry to General education courses.

**Assessment Methodology**

**PSO 1: Be able to demonstrate basic knowledge in the core areas of chemistry (analytical, general, inorganic, organic and physical, pharmaceutical, green chemistry, polymer chemistry etc).**

Direct method of computing PSO 1 attainment is based on the student performance in all assessment instruments namely online and offline - subjective and objective tests for all the courses offered (CH 1201, CH 2201, CH 3201, CH 4201, CH 5201, CH 5205, CH 6201, CH E1 6201, CH A1 6201, CH A2 6201, CH A3 6201, CH B1 6201, CH B2 6201, CH B3 6201). These exams test students' learning at knowledge, understanding and application levels in the respective courses. Indirect method of computing PSOs is done through students' course exit

survey wherein a structured questionnaire is administered to the students and their response is solicited on a 5 point scale. Responses are consolidated and students' satisfaction level with reference to course transaction is computed. Average percentage of level of attainments of all the courses in chemistry is given below.

**Level of attainment of PSO1 (all theory courses offered by the department): 78.5%**

**PSO 2: Be versatile in classical laboratory techniques, use instrumental methods for analysis as well as synthesis and follow standardised procedures and regulations in handling and disposal of chemicals.**

PSO 2 attainment level is ascertained based on continuous assessment (throughout) and summative assessment (at the end of) in every semester. This direct assessment involves testing students' knowledge on standardised procedures, their skill in executing them and their compliance with regulations in handling and disposal of chemicals in the conduct of all the laboratory courses (CH 1251, CH 2251, CH 3251, CH 4251, CH 5251, CH 5255, CH 6251, CH E1 6251, CH A1 6251, CH A2 6251, CH A3 6251). Average percentage of level of attainments of all the practical courses in chemistry is given below.

**Level of attainment PSO2 (all practical courses offered by the department): 88.8%**

**PSO 3: Be able to access, scout and use the chemical literature and also able to work as a member of a team.**

Attainment of PSO 3 is ascertained through the practical course CH 6251 by assessing project study as one of the experiments. This project work provides an opportunity for the student to apply knowledge and skills obtained in chemistry theory and practical coursework. From a list of relevant application level topics provided by the dept., Students choose one topic for study, based on their own interest. Like minded students form teams of 4 to 5 members and plan & execute the task. The study is followed by collective report submission and individual oral presentation. Attainment of this learning outcome is ensured and assessed by the concerned faculty member at every stage through direct as well as indirect guidance and monitoring.

**Level of attainment of PSO3 (projects done by the students): ----100%**

**PSO 4: Be able to integrate knowledge gained in Chemistry to current environmental issues.**

Assessment of this learning outcome is largely done through the undergraduate general education course namely Environmental Science. This course provides an opportunity for the students to apply chemistry knowledge to understand the cause and identify the solution to environmental problems. Direct method of computing PSO 4 attainment is based on the student performance in all assessment instruments namely formative and summative tests in courses on environment as well as a report on the study on environment issues. Average percentage of level of attainments of this course is given below.

**Level of attainment of PSO4 (Environmental science offered by the college): 88.5%**

**Level of attainment measurement**

Level of attainment of course outcomes includes both direct and indirect assessments. Direct assessment is done by testing the knowledge and/or skills of the student in that course by conducting standardised examinations. In indirect assessment we use the student feedback on course which is measured on 5 point scale. The sum of these two assessments is shown as the level of attainment of that course.

**Assessment of all the theory courses** is done in two parts, namely by formative assessment (40%) which is internal and summative assessment (60%) which is external. The evaluation of 100% of the assessment in each semester is distributed as follows:

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| Mid Semester Examination 1 | 15% (which is offline)                     |
| Mid Semester Examination 2 | 15% (which is online)                      |
| Accessory Assessment       | 5% (written quiz, Assignment etc.)         |
| Attendance                 | 5% (above 75% attendance will be rewarded) |
| End semester examination   | 60% (which is descriptive)                 |

**Assessment of all the practical courses:** Assessment is done in two parts, namely by continuous assessment (40%) and summative assessment (60%). In Continuous assessment each practical course will be assessed for 40% by considering the 50% (best scored) of the experiments and the total will be calculated for 40%. Summative assessment (60%) of practical courses is through end semester practical exams designed to test student's

knowledge as well as skills in the conduct of experiments and generation of reliable results. A written record of experimental work carried out throughout the semester is also assessed.

**Assessment of Environmental Science:** The evaluation of 100% of the assessment in environmental science is distributed as follows:

Continuous assessment involving field study, written test, presentation of project findings etc.  
30%

Participation & Involvement in the course 10% (above 75% attendance will be rewarded)

End semester examination 60% (which is descriptive)

**Assessment of Project work:** Project work is assessed as one of the experiments in the practical course CH 6251 by the concerned faculty member through direct and indirect guidance and monitoring (Content in the report, Presentation, Viva).

**Course outcomes of all the courses offered by chemistry department**

| Code             | Title of the paper              | After the completion of the course student should be able to   |
|------------------|---------------------------------|--|
| CH 1201<br>(Th.) | Inorganic and Organic Chemistry | <p>Students will be able to</p> <p><b>CO1:</b> Gain insight into various theories on chemical bonding- VSEPR theory and molecular orbital theory.</p> <p><b>CO2:</b> Be able to apply the theoretical knowledge to predict the structure of molecules</p> <p><b>CO3:</b> Acquire knowledge on the basis of classification of elements and trends in general properties of s&amp;p block elements</p> <p><b>CO4:</b> Understand the physical and chemical properties of selected inorganic compounds</p> <p><b>CO5:</b> Acquire knowledge on synthesis &amp; structure of diborane and higher boranes and boron – nitrogen compounds.</p> <p><b>CO6:</b> Understand the preparation, properties and applications of silanes , silicones, Inter halogen compounds , pseudo halogens, Hydrazine , Hydroxyl amine &amp; oxides.</p> <p><b>CO7:</b> Study the nomenclature, preparation and factors affecting stability of cyclo alkanes.</p> |

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|   |  | <p><b>CO8:</b> Establish bond strength, bond order and magnetic nature of homo and hetero atomic molecules.</p> <p><b>CO9:</b> knowledgeable on the basics of organic chemistry like types of organic reactions, reagents and intermediates.</p> <p><b>CO10:</b> Study the structure of benzene, understand the concept of aromaticity, orientation influence of substituents on the ring.</p>  |
| <b>Level of attainment of CO1 to CO10: -----74.4%</b> |  |   |
| CH 1251<br>(Pr.)                                      | Qualitative Inorganic<br>Analysis - I  | <p><b>CO1:</b> Make use of standardised procedures for the analysis of inorganic salts.</p> <p><b>CO2:</b> Acquire necessary skills for qualitative analysis of radicals</p> <p><b>CO3:</b> Carry out qualitative analysis of salts containing one anion and one cation.</p> <p><b>CO4:</b> Understand the regulations in handling and disposal of chemicals.</p>   |
| <b>Level of attainment of CO1 to CO4: -----84.84%</b> |  |   |
| CH 2201<br>Th.  | General and Organic<br>Chemistry       | <p><b>CO1:</b> Acquire knowledge on toxic elements in the environment &amp; the effects of toxic elements.</p> <p><b>CO2:</b> Gain awareness on air pollution.</p> <p><b>CO3:</b> Acquire knowledge on water pollution, unique physical and chemical properties of water and hardness of water.</p> <p><b>CO4:</b> Develop insight in the synthesis and applications of Carboxylic acids.</p> <p><b>CO5:</b> Learn basics of organic chemistry.</p> <p><b>CO6:</b> Acquire Knowledge on Synthesis of aceto acetic ester and Malonic ester.</p> <p><b>CO7:</b> Describe the applications of Ethylacetoacetic ester.</p> <p><b>CO8:</b> Learn about different types of reactions.</p> <p><b>CO9:</b> Acquire knowledge on synthesis and structure of Carbonyl compounds.</p> <p><b>CO10:</b> Describe the applications of Carbonyl compounds.</p> |
| <b>Level of attainment of CO1 to CO10: 72.2%</b>      |  |   |
| CH 2251<br>Pr.  | Qualitative Inorganic<br>Analysis - II | <p><b>CO1:</b> Make use of standardised procedures for the analysis of inorganic mixtures.</p>  |

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|  |                    | <p><b>CO2:</b> Gain the necessary skills to work at semi micro level</p> <p><b>CO3:</b> Carry out qualitative analysis of mixtures containing two anions and two cations.</p> <p><b>CO4:</b> Understand the regulations in handling and disposal of chemicals.</p>  |
| <b>Level of attainment of CO1 to CO4:</b> 89.83% |                    |   |
| CH 3201<br>Th.                                   | Physical Chemistry | <p><b>CO1:</b> Acquire the ability to identify and establish the fact that no gas is an ideal gas and all gases behave as ideal gases only under high temp. and low pressure condition</p> <p><b>CO2:</b> Derive equations for Van der Waal's Constants in terms of critical constants and deduced the law of corresponding states in terms of reduced equation of state</p> <p><b>CO3:</b> Understand the importance and application of Joule Thomson Effect in cooling devices and liquid crystals in electronic devices and thermography</p> <p><b>CO4:</b> Identify the importance of acid/base catalyst in homogeneous and surface catalysed reactions.</p> <p><b>CO5:</b> Gain insight on the importance and understood the salient features of enzyme catalysed reactions in living systems. Derived the Michaelis Menten Equation and identified the significance of Michaelis Constant</p> <p><b>CO6:</b> Derive Gibb's Phase Rule Equation and understood its universality and significance in the study of heterogeneous systems at equilibrium</p> <p><b>CO7:</b> Apply phase rule equation to study 1C3P(H<sub>2</sub>O) and 2C3P(Ag-Pb, NaCl- H<sub>2</sub>O ) systems with the help of phase diagram</p> <p>CO8: Derive equations for 0, I,II and III order reactions</p> <p>CO9: Understand the various types of methods to find order of reactions and collision theory of reaction rates.</p> <p>CO10: Develop insights on classification, stability and protective ability of colloids, emulsions and gels.</p> <p>CO11: Understand the laws of photochemistry (Grothus Draper</p> |

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|  |                        | <p>Law and Stark Einstein law)</p> <p>CO12: Develop insight on the concept low and high quantum yield and electronic transitions (fluoresce and phosphorescence) from Jablonski diagram.</p>   |
| <p><b>Level of attainment of CO1 to CO12: 72.4%</b></p>  |                        |  |
| CH 3251<br>Pr.   | Volumetric analysis -I | <p>CO1: Calibrate the apparatus like volumetric flask, pipette and burette.</p> <p>CO2: Carry out qualitative analysis of Oxidising and reducing agents</p> <p>CO3: Learn the applications of types of titrations for various estimations</p> <p>CO4: Carry out quantitative analysis by volumetric method</p> <p>CO5: Acquired basic knowledge on conductometric titrations</p> <p>CO6: Correlate the experimental results with the class room learning.</p>  |
| <p><b>Level of attainment of CO1 to CO6: 85.31%,</b></p> |                        |  |
| CH 4201<br>Th.   | Inorganic Chemistry    | <p><b>CO1:</b> Acquire knowledge on the classification of elements, general properties (variable oxidation states, colour, complex formation catalytic activity, magnetic properties etc.) of d &amp; f block elements.</p> <p>CO2: Gain knowledge about separation techniques of lanthanides</p> <p>CO3: Understand the basic concept of the co-ordination compounds, and identify the types of given ligands.</p> <p>CO4: Knowledgeable about assumptions, drawbacks of Werner's theory of complexes, and isomerism in complexes.</p> <p>CO5: Understand Effective atomic number (EAN) and make use of that knowledge to calculate EAN for any given complexes.</p> <p>CO6: Develop insight in the modern theories of metal-ligand complexes i.e. valence bond theory, CFT, trans effect and its applications.</p> <p>CO7: Apply CFT to different geometries ie. Square planer, tetrahedral, Octahedral.</p> <p>CO8: Calculate Spin magnetic moment, crystal field stabilization</p> |

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|  |                                | <p>energy related to weak and strong field complexes.</p> <p>CO9: Understand symmetry in crystals, Laws of constancy and laws of rationality, defects in crystals, biological significance of essential elements, labile and inert complexes.</p> <p>CO10: Derive Braggs equation.</p>  |
| <b>Level of attainment of CO1 to CO10: 78.1%</b> |                                |   |
| CH 4251<br>Pr.                                   | Synthesis of organic compounds | <p><b>CO1:</b> Make use of standardised procedures for the synthesis of Organic compounds</p> <p><b>CO2:</b> Carry out single step synthesis of organic compounds</p> <p><b>CO3:</b> Acquire skills on techniques of crystalization</p> <p><b>CO4:</b> Understand the regulations in handling and disposal of chemicals.</p> <p><b>CO5:</b> Acquire basic knowledge on purification of solid, liquid components</p>   |
| <b>Level of attainment of CO1 to CO5: 92%</b>    |                                |   |
| CH 5201<br>Th.                                   | Organic chemistry              | <p><b>CO1:</b> Gain knowledge on synthetic approach and physical and chemical properties of nitro alkanes</p> <p><b>CO2:</b> Understand the preparations, name reactions, basic properties of amines.</p> <p><b>CO3:</b> Depict the mechanism of named reactions</p> <p><b>CO4:</b> Gain knowledge pertaining to life molecules, different types of carbohydrates, classification, structure and Establishment of Monosaccharides</p> <p><b>CO5:</b> Apply the knowledge on inter conversion of one monosaccharide to another Killyani synthesis.</p> <p><b>CO6:</b> Develop insight and analytical thinking on organic spectroscopic techniques.</p> <p><b>CO7:</b> Interpret different functional groups and identify with characteristic absorptions and signals.</p> <p><b>CO8:</b> Predict NMR signals with corresponding chemical shifts</p> <p><b>CO9:</b> Develop knowledge required for industrial ethical requirement</p> |
| <b>Level of attainment of CO1 to CO9: 71.5%</b>  |                                |   |



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| CH 5251<br>Pr.                                 | Organic qualitative<br>analysis     | <p><b>CO1:</b> Make use of standardised procedures for the analysis of organic compound</p> <p><b>CO2:</b> Acquire skills in identifying functional groups</p> <p><b>CO3:</b> Learn the process of derivatization</p> <p><b>CO4:</b> Carryout distillation for pure sample along with the B.Pt.</p> <p><b>CO5:</b> Understand the handling of volatile / corrosive/solvents</p> <p><b>CO6:</b> Gain the necessary skills of handling Melting point instrument</p>  |
| <b>Level of attainment of CO1 to CO6: 84%</b>  |                                     |  |
| CH 5202<br>Th.                                 | Physical and inorganic<br>chemistry | <p><b>CO1:</b> Acquire knowledge on different types of vapour pressure – composition and temperature curves, partially miscible liquids and their different types, Nernst distribution law and its applications.</p> <p><b>CO2:</b> Understand colligative properties like relative lowering of vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure and their relation with molecular weights.</p> <p><b>CO3:</b> Gain insight on ideal solutions, Raoult's law, Non-ideal solutions, azeotropes and fractional distillation.</p> <p><b>CO4:</b> Understand specific and equivalent conductance.</p> <p><b>CO5:</b> Acquire knowledge of Kohlrausch's law and application of it.</p> <p><b>CO6:</b> Able to find the transport number using Hittorf method</p> <p><b>CO7:</b> Distinguish spontaneous and non spontaneous processes and electrochemical and electrolytic cells.</p> <p><b>CO8:</b> Develop insight on the importance of salt bridge in electrochemical cell and different types of single reversible electrodes.</p> <p><b>CO9:</b> Understand the applications of conductivity measurements and potentiometric measurements</p> <p><b>CO10:</b> Acquire knowledge on classification, naming, preparation and properties of organometallic compounds.</p> |
| <b>Level of attainment of CO1 to CO10: 71%</b> |                                     |  |

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| CH 5252<br>Pr.                                   | Physical experiments              | <p><b>CO1:</b> Make use of standardised procedures for the detection of Physical properties.</p> <p><b>CO2:</b> Learn to calculate surface tension and viscosity of the unknown solvents.</p> <p><b>CO3:</b> Perform hydrolysis of methyl acetate to calculate rate constants for 1st order reaction.</p> <p><b>CO4:</b> Acquire necessary Skill in determining the distribution constant</p> <p><b>CO5:</b> Correlate the experimental results with the class room learning.</p>  |
| <b>Level of attainment of CO1 to CO5: 82%</b>    |                                   |  |
| CH-E1-<br>6201<br>Th.                            | Some special aspects of chemistry | <p><b>CO1:</b> Students understand the implications and apply the law of conservation of energy.</p> <p><b>CO2:</b> Derive equations for work done under isothermal, adiabatic, reversible and irreversible conditions.</p> <p><b>CO3:</b> Understand the isoenthalpic nature of Joule-Thomson Effect and identify the conditions needed for cooling to be caused.</p> <p><b>CO4:</b> Establish reaction feasibility based on second law of thermodynamics</p> <p><b>CO5:</b> Identify, understand and arrive at equations for W and <math>\Delta S</math> for reversible, irreversible and equilibrium processes.</p> <p><b>CO6:</b> Depict 3 dimensional molecules on two dimensional surfaces and assign D, L-R, S notations to stereogenic centres.</p> <p><b>CO7:</b> Develop insights on optical and geometric isomerism.</p> <p><b>CO8:</b> Gained basic knowledge on Asymmetric synthesis involving stereospecific and stereoselective reactions.</p> <p><b>CO9:</b> Acquire knowledge on nitrogenous biomolecules. The monomers of amino acids of polymeric protein chain.</p> <p><b>CO10:</b> Gain detailed knowledge on classification, preparation and properties of amino acid and protein structure. The link between the peptide bond and its characterization.</p> |
| <b>Level of attainment of CO1 to CO10: 83.5%</b> |                                   |  |

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| CH E1<br>6251                                 | Gravimetric analysis                              | <p><b>CO1:</b> Make use of standardise procedures for the Gravimetric analysis</p> <p><b>CO2:</b> learn the skills of Precipitation process, digestion, filtration, incineration etc.</p> <p><b>CO3:</b> Acquire practical Knowledge of co-precipitation</p> <p><b>CO4:</b> Handle sintered glass funnel</p> <p><b>CO5:</b> Carryout periodical heating followed by weighing</p>  |
| <b>Level of attainment of CO1 to CO5: 88%</b> |   |   |
| CH-E2-<br>6201<br>Th.                         | Analytical methods in chemistry                   | <p>CO1: Understand the various steps and mechanisms involved in the conduct of reactions, titrations</p> <p>CO2: Gain insight into the separation techniques in chemical analysis</p> <p>CO3: Acquire detailed knowledge of Chromatography.</p> <p>CO4: Acquire the knowledge of Theories of acid-base, redox, complexometric, iodometric and precipitation titrations.</p> <p>CO5: Identify the choice of indicators for the titrations and Principles of gravimetric analysis</p> <p><b>CO6:</b> Classify chromatography methods, principles of differential migration adsorption phenomenon.</p> <p><b>CO7:</b> Depict the Nature of adsorbents, solvent systems, <math>R_f</math> values, factors effecting <math>R_f</math> values</p> |
| Bench Mark set for the paper: 80%             |   |   |
| CH-E2-<br>6251<br>Pr.                         | Instrumental analysis & chromatography techniques | <p><b>CO1:</b> Make use of standardise procedures for Instrumental analysis</p> <p><b>CO2:</b> Handle Potentiometer, pH meter, Colorimeter and polarimeter for the quantitative chemical analysis</p> <p>CO3: Acquire skills of preparing standard solutions, and conducting titrations</p> <p>CO4: Learn the chromatography techniques like Column, TLC and Paper</p> <p>CO5: Check the purity of compounds by TLC.</p> <p>CO6: Interpret IR spectral data to study the structure of molecules</p>   |
| Bench Mark set for the paper: 85%             |   |   |

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| CH<br>6201                                     | A1 | Pharmaceutical and medicinal chemistry | <p><b>CO1:</b> Acquire knowledge on the terminology, nomenclature adopted in the pharmaceuticals</p> <p><b>CO2:</b> Identify and understand in classifying various drug models based on their therapeutic action</p> <p><b>CO3:</b> Describe various synthesis for drugs which are used in daily life.</p> <p><b>CO4:</b> Develop insight of different drugs used in daily life.</p> <p><b>CO5:</b> Gain detailed knowledge about different drugs and their activities on a particular disease</p> <p><b>CO6:</b> Identify the reasons for HIV and the preventive measures for it.</p>   |
| <b>Level of attainment of CO1 to CO6: 84.5</b> |    |  |  |
| CH<br>6251                                     | A1 | Volumetric analysis -II                | <p><b>CO1:</b> Make use of standardised procedures for Instrumental analysis</p> <p><b>CO2:</b> Handle Conductometer</p> <p><b>CO3:</b> Acquire skills of preparing standard solutions, conductometric titrations</p> <p><b>CO4:</b> Carry out quantitative analysis by Conductometric method</p> <p><b>CO5:</b> Correlate the experimental results with the class room learning.</p>  |
| <b>Level of attainment of CO1 to CO5: 91%</b>  |    |  |  |
| CH<br>6201                                     | A2 | Green chemistry                        | <p><b>CO1:</b> Gain insight into basic chemistry principles</p> <p><b>CO2:</b> Apply the knowledge to atom economic reactions</p> <p><b>CO3:</b> Understand the ionic aqueous phase reactions</p> <p><b>CO4:</b> Acquire knowledge on the green solvents and Solvent free reactions</p> <p><b>CO5:</b> Understand and identify alternative conventional fuel saving named reactions</p> <p><b>CO6:</b> Acquire knowledge on liquid CO<sub>2</sub> and its applications'</p> <p><b>CO6:</b> Gain knowledge Microwave assisted synthesis</p> <p><b>CO7:</b> Critical appreciation and usage of Ultra sound energy Sonicator based reactions</p> <p><b>CO8:</b> Gain insight of Synthesis of solvent free reactions</p> |

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|  |                                       | <p>CO9: Describe the applications of Green catalyst PTC, Crown Ethers</p> <p><b>CO10:</b> More environmentally conscious while working in industry</p>   |
| <b>Level of attainment of CO1 to CO10:</b> 87.7% |                                       |  |
| CH 6251  | A2<br>Reactions with green procedures | <p><b>CO1:</b> Apply the theoretical knowledge of Green chemical procedures in synthesis</p> <p><b>CO2:</b> Identify and discriminate, the safe and toxic solvents</p> <p><b>CO3:</b> Acquire skills of working at solvent free reactions</p> <p><b>CO4:</b> Gain the necessary skills to perform alternative fuel saving reactions</p> <p><b>CO5:</b> Understand ethical responsibility to sustain the environment</p> <p><b>CO6:</b> Carryout collective project study and acquired the ability of presentation skills</p>   |
| <b>Level of attainment of CO1 to CO6:</b> 93.43% |                                       |  |
| CH 6201  | A3<br>Polymer chemistry               | <p>CO1: Understand the basic concepts of polymerization.</p> <p>CO2: Identify different types of polymers in our daily life and able to distinguish.</p> <p>CO3: Develop insights about the different methods of polymerization.</p> <p>CO4: Identify and Understand various techniques of polymerization.</p> <p>CO5: Gain knowledge about the preparation, properties and applications of PE, PVC, Polystyrene, polyacrilonytrile,</p> <p>CO6: Gain detailed knowledge on the concept Glass transition temperature</p> <p>CO7: Acquire the knowledge of what are biodegradable polymers to have social awareness and to promote awareness in society.</p> <p>CO8: Determine the molecular weights of polymers using osmometry, viscometry and light scattering methods.</p> <p>CO9: Apply kinetics to free radical polymerization</p> <p>CO10: Understand the functions and uses of various types of</p> |

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|  |  | polymer additives  |
| <b>Level of attainment of CO1 to CO7: 89.4%</b>  |  |  |
| CH<br>6251<br>Pr.                                | A3<br>Water analysis                               | <p>CO1: Acquire the ability to standardise the pH meter and determine the pH of different water samples at room temperature.</p> <p>CO2: Estimate the amount of total dissolved solids by measuring the conductivity.</p> <p>CO3: Gain the necessary skill set to establish the temporary, permanent and total hardness in the given sample through complexometric titration with standardised EDTA.</p> <p>CO4: Perform standardised acid- water (base) titrations with two different indicators at two different pH conditions and used the data to determine total alkalinity.</p> <p>CO5: Learn to calculate the bicarbonate and carbonate amounts in the given sample through acid water titrations.</p>  |
| <b>Level of attainment of CO1 to CO5: 97.62%</b> |  |  |
| CH<br>6201<br>Th.                                | B1<br>Fuel chemistry and batteries                 | <p>CO1: Understand Classification of fuels and their calorific value</p> <p>CO2: Develop insight into Fractionation of coal tar – uses of coal tar based chemicals</p> <p>CO3: Depict the Composition of crude petroleum , refining and different types of petroleum products and their applications</p> <p>CO4: Acquire the knowledge about Petro chemicals : vinyl acetate , propylene oxide , isoprene , butadiene , toluene and its derivative xylene</p> <p>CO5: Understand the Classification of lubricants, Properties of lubricants and their determination</p> <p>CO6: Identify Primary and secondary batteries, Characteristics of Batteries and working</p> <p>CO7: Gain detailed knowledge about Fuel cells, Solar cell and polymer cell</p> |
| Bench Mark set for the paper: 75%                |  |  |
| CH<br>6201<br>Th.                                | B2<br>Inorganic Materials of Industrial Importance | <p>CO1: Acquire knowledge on the basis of classification of elements, trends and general properties of s &amp; p block elements</p> <p><b>CO2:</b> Understand the physical and chemical properties of</p>  |

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|                                   |   | <p>selected inorganic compounds</p> <p>CO3: Identify the Glassy state and its properties, understand classification Manufacture and processing, Composition and properties of glass.</p> <p><b>CO4:</b> Gain insight into the Types and manufacture of Ceramics. High technology ceramics and their applications</p> <p>CO5: Gain detailed knowledge about the Manufacture of cement and the setting process, quick setting cements.</p> <p>CO6: Classify different types of fertilizers, Manufacture and compound and mixed fertilizers</p> <p><b>CO7:</b> Acquire the knowledge about Surface Coatings, Fillers, Thinners, Enamels, emulsifying agents and Special paints</p> <p>CO8: Classify alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys and Manufacture</p> <p>CO9: Establish the origin of explosive properties in organic compounds, preparation and explosive properties</p> |
| Bench Mark set for the paper: 80% |   |  |
| CH B3<br>6201<br>Th.              | Analysis of applied industrial products | <p>CO1: Understand the Analysis of soaps and paints</p> <p>CO2: Acquire the knowledge of Analysis of oils, saponification value, iodine value, acid value, ester value, bromine value, acetyl value</p> <p>CO3: Identify the Analysis of industrial solvents like benzene, acetone, methanol and acetic acid.,</p> <p>CO4: Determine the methoxyl and N-methyl groups</p> <p>CO5: Analyse the fertilizers like urea, NPK fertilizer, super phosphate,</p> <p>CO6: Gain insight into the Analysis of DDT, BHC, endrin, endosulfone, malathion, parathion.</p> <p>CO7: Understand the Analysis of starch, sugars, cellulose and paper.</p> <p>CO8: Learn the Analysis of fuel gases like: water gas, producer gas, kerosene gas.</p> <p><b>CO9:</b> Acquire the knowledge about Analysis of cement- loss on</p>  |

|                                   |  |   |
|-----------------------------------|--|---|
|                                   |  | <p>ignition, insoluble residu, total silica, sesqui oxides, lime, magnesia, ferric oxide, sulphuric anhydrid.</p> <p><b>CO10:</b> Analyse and Determined silica, sulphuur, barium, arsenic, antimony, total R<sub>2</sub>O<sub>3</sub>, calcium, magnesium, total alkalies, aluminium, chloride, floride in glass</p> |
| Bench Mark set for the paper: 75% |  |   |

### Input mapping of COs correlation with PSOs

| Code    | COs  | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
|---------|------|-------|-------|-------|-------|
| CH 1201 | CO1  | 3     |       |       |       |
|         | CO2  | 3     |       |       |       |
|         | CO3  | 3     |       |       |       |
|         | CO4  | 3     |       |       |       |
|         | CO5  | 3     |       |       |       |
|         | CO6  | 3     |       |       |       |
|         | CO7  | 3     |       |       |       |
|         | CO8  | 3     |       |       |       |
|         | CO9  | 3     | 2     |       |       |
|         | CO10 | 3     | 2     |       |       |
|         |      |       |       |       |       |
| CH 1251 | CO1  |       | 3     |       |       |
|         | CO2  |       | 3     |       |       |
|         | CO3  |       | 3     |       |       |
|         | CO4  |       | 3     | 2     |       |
|         |      |       |       |       |       |
| CH 2201 | CO1  | 3     |       |       | 3     |
|         | CO2  | 3     |       |       | 3     |
|         | CO3  | 3     |       |       | 3     |
|         | CO4  | 3     | 2     |       |       |
|         | CO5  | 3     | 2     |       |       |
|         | CO6  | 3     |       |       |       |
|         | CO7  | 3     |       |       |       |



|         |      |   |   |   |   |
|---------|------|---|---|---|---|
|         | CO8  | 3 | 2 |   |   |
|         | CO9  | 3 | 2 |   |   |
|         | CO10 | 3 |   |   |   |
|         |      |   |   |   |   |
| CH 2251 | CO1  |   | 3 |   |   |
|         | CO2  |   | 3 |   |   |
|         | CO3  |   | 3 |   |   |
|         | CO4  |   | 3 | 2 |   |
|         |      |   |   |   |   |
| CH 3201 | CO1  | 3 |   |   |   |
|         | CO2  | 3 |   |   |   |
|         | CO3  | 3 |   |   | 3 |
|         | CO4  | 3 | 3 |   |   |
|         | CO5  | 3 |   |   | 1 |
|         | CO6  | 3 | 2 |   |   |
|         | CO7  | 3 | 2 | 1 |   |
|         | CO8  | 3 | 2 |   |   |
|         | CO9  | 3 | 1 |   |   |
|         | CO10 | 3 |   |   |   |
|         | CO11 | 3 |   |   |   |
|         | CO12 | 3 |   |   |   |
|         |      |   |   |   |   |
| CH 3251 | CO1  |   | 3 |   |   |
|         | CO2  | 2 | 3 | 2 |   |
|         | CO3  | 3 | 3 | 2 | 1 |
|         | CO4  |   | 3 | 2 |   |
|         | CO5  |   | 3 | 2 |   |
|         | CO6  | 1 | 3 |   |   |
|         |      |   |   |   |   |
| CH 4201 | CO1  | 3 |   |   |   |
|         | CO2  | 3 |   |   |   |
|         | CO3  | 3 | 1 |   |   |

|         |      |   |   |   |   |
|---------|------|---|---|---|---|
|         | C04  | 3 |   |   |   |
|         | C05  | 3 |   |   |   |
|         | C06  | 3 |   |   |   |
|         | C07  | 3 |   |   |   |
|         | C08  | 3 |   |   |   |
|         | C09  | 3 |   |   |   |
|         | C010 | 3 |   |   |   |
|         |      |   |   |   |   |
| CH 4251 | C01  |   | 3 |   |   |
|         | C02  |   | 3 |   |   |
|         | C03  |   | 3 | 1 |   |
|         | C04  |   | 3 | 1 |   |
|         | C05  |   | 3 | 1 |   |
|         |      |   |   |   |   |
| CH 5201 | C01  | 3 |   |   |   |
|         | C02  | 3 |   |   |   |
|         | C03  | 3 | 2 |   |   |
|         | C04  | 3 |   |   |   |
|         | C05  | 3 |   |   |   |
|         | C06  | 3 | 2 |   |   |
|         | C07  | 3 | 2 |   |   |
|         | C08  | 3 | 1 |   |   |
|         | C09  | 3 |   |   | 3 |
|         |      |   |   |   |   |
| CH 5251 | C01  |   | 3 |   |   |
|         | C02  |   | 3 | 1 |   |
|         | C03  |   | 3 | 1 |   |
|         | C04  |   | 3 |   |   |
|         | C05  |   | 3 | 1 |   |
|         | C06  |   | 3 | 1 |   |
|         |      |   |   |   |   |
| CH 5202 | C01  | 3 |   |   |   |

|            |      |   |   |   |   |
|------------|------|---|---|---|---|
|            | C02  | 3 |   |   |   |
|            | C03  | 3 |   |   |   |
|            | C04  | 3 | 1 |   |   |
|            | C05  | 3 |   |   |   |
|            | C06  | 3 |   |   |   |
|            | C07  | 3 |   |   |   |
|            | C08  | 3 |   |   |   |
|            | C09  | 3 | 2 |   |   |
|            | C010 | 3 | 1 |   |   |
|            |      |   |   |   |   |
| CH 5252    | C01  | 2 | 3 |   |   |
|            | C02  | 2 | 3 |   |   |
|            | C03  | 3 | 3 |   |   |
|            | C04  | 2 | 3 |   |   |
|            | C05  | 1 | 3 |   |   |
|            |      |   |   |   |   |
| CH-E1-6201 | C01  | 3 | 3 | 2 |   |
|            | C02  | 3 | 2 | 2 |   |
|            | C03  | 3 | 2 | 2 | 2 |
|            | C04  | 3 | 2 | 2 |   |
|            | C05  | 3 | 2 | 2 | 1 |
|            | C06  | 3 | 1 | 2 | 1 |
|            | C07  | 3 | 1 | 1 |   |
|            | C08  | 3 |   |   |   |
|            | C09  | 3 |   |   |   |
|            | C010 | 3 |   |   |   |
|            |      |   |   |   |   |
| CH E1 6251 | C01  |   | 3 | 1 |   |
|            | C02  |   | 3 | 1 |   |
|            | C03  |   | 3 |   |   |
|            | C04  |   | 3 |   |   |
|            | C05  |   | 3 |   |   |

|            |     |   |   |   |  |
|------------|-----|---|---|---|--|
|            |     |   |   |   |  |
| CH-E2-6201 | C01 | 3 |   | 1 |  |
|            | C02 | 3 |   | 1 |  |
|            | C03 | 3 | 1 |   |  |
|            | C04 | 3 | 1 |   |  |
|            | C05 | 3 | 2 |   |  |
|            | C06 | 3 | 1 |   |  |
|            | C07 | 3 | 2 |   |  |
|            |     |   |   |   |  |
| CH-E1-6251 | C01 |   | 3 |   |  |
|            | C02 |   | 3 |   |  |
|            | C03 |   | 3 |   |  |
|            | C04 |   | 3 |   |  |
|            | C05 |   | 3 |   |  |
|            | C06 |   | 3 |   |  |
|            |     |   |   |   |  |
| CH A1 6201 | C01 | 3 |   |   |  |
|            | C02 | 3 |   |   |  |
|            | C03 | 3 | 2 |   |  |
|            | C04 | 3 |   | 1 |  |
|            | C05 | 3 |   | 1 |  |
|            | C06 | 3 |   | 1 |  |
|            |     |   |   |   |  |
| CH A1 6251 | C01 | 2 | 3 | 2 |  |
|            | C02 | 1 | 3 | 2 |  |
|            | C03 | 1 | 3 | 2 |  |
|            | C04 | 2 | 3 | 3 |  |
|            | C05 | 1 | 3 | 1 |  |
|            |     |   |   |   |  |
| CH A2 6201 | C01 | 3 | 3 |   |  |
|            | C02 | 3 | 3 |   |  |
|            | C03 | 3 | 3 | 1 |  |

|            |      |   |   |   |   |
|------------|------|---|---|---|---|
|            | CO4  | 3 | 3 | 1 |   |
|            | CO5  | 3 |   |   |   |
|            | CO6  | 3 | 1 |   |   |
|            | CO7  | 3 |   |   |   |
|            | CO8  | 3 | 1 |   |   |
|            | CO9  | 3 |   |   |   |
|            | CO10 | 3 |   | 3 |   |
|            |      |   |   |   |   |
| CH A2 6251 | CO1  |   | 3 |   | 1 |
|            | CO2  |   | 3 |   | 2 |
|            | CO3  |   | 3 |   | 2 |
|            | CO4  |   | 3 |   | 2 |
|            | CO5  |   | 3 |   | 2 |
|            | CO6  |   | 3 | 3 |   |
|            |      |   |   |   |   |
| CH A3 6201 | CO1  | 3 |   |   |   |
|            | CO2  | 3 |   |   |   |
|            | CO3  | 3 |   |   |   |
|            | CO4  | 3 |   |   |   |
|            | CO5  | 3 |   |   |   |
|            | CO6  | 3 |   |   |   |
|            | CO7  | 3 |   |   | 1 |
|            | CO8  | 3 |   |   |   |
|            | CO9  | 3 |   |   |   |
|            | CO10 | 3 |   |   |   |
|            |      |   |   |   |   |
| CH A3 6251 | CO1  | 2 | 3 | 3 | 3 |
|            | CO2  | 3 | 3 | 3 | 2 |
|            | CO3  | 3 | 3 | 3 | 3 |
|            | CO4  | 3 | 3 | 3 | 3 |
|            | CO5  | 3 | 3 | 3 | 3 |
|            |      |   |   |   |   |

|            |      |   |   |   |   |
|------------|------|---|---|---|---|
| CH B1 6201 | CO1  | 3 |   |   | 2 |
|            | CO2  | 3 |   |   | 2 |
|            | CO3  | 3 |   |   | 2 |
|            | CO4  | 3 |   |   |   |
|            | CO5  | 3 |   |   |   |
|            | CO6  | 3 | 1 |   |   |
|            | CO7  | 3 |   |   | 2 |
|            |      |   |   |   |   |
| CH B2 6201 | CO1  | 3 | 2 |   |   |
|            | CO2  | 3 | 2 |   |   |
|            | CO3  | 3 |   |   |   |
|            | CO4  | 3 |   |   |   |
|            | CO5  | 3 |   |   |   |
|            | CO6  | 3 |   |   | 2 |
|            | CO7  | 3 |   |   |   |
|            | CO8  | 3 |   |   |   |
|            | CO9  | 3 | 2 |   |   |
|            |      |   |   |   |   |
| CH B3 6201 | CO1  | 3 |   |   |   |
|            | CO2  | 3 |   |   |   |
|            | CO3  | 3 | 2 |   |   |
|            | CO4  | 3 |   |   |   |
|            | CO5  | 3 |   |   | 2 |
|            | CO6  | 3 |   |   |   |
|            | CO7  | 3 | 2 |   |   |
|            | CO8  | 3 |   |   |   |
|            | CO9  | 3 |   |   |   |
|            | CO10 | 3 |   | 1 |   |
|            |      |   |   |   |   |

Strongly correlated: 3

Moderately correlated: 2

Weakly correlated: 1