



# **CURRICULUM & ITS RELEVANCE**

**DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY**  
**GOVT. M. H. COLLEGE OF HOME SCIENCE AND SCIENCE FOR WOMEN, JABALPUR**  
**SESSION FROM 2019 -20 TO 2023-24**



**1.1.1 Curriculum and its relevance to Local! Regional! National! Global needs**  
**Department of Chemistry**

| S. No. | Course Name                                         | Course Code | Local | Regional | National | Global | Curriculum - its relevance                                                                                                                                                                                                                                                                                                                            |
|--------|-----------------------------------------------------|-------------|-------|----------|----------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Fundamentals of Chemistry (Major)                   | S1-CHEM1T   | ✓     | ✓        | ✓        |        | Ancient Indian chemical techniques.                                                                                                                                                                                                                                                                                                                   |
|        |                                                     |             | ✓     | ✓        | ✓        | ✓      | Various theories and principles applied to reveal atomic structure. Significance of quantum numbers. Concept of periodic properties of elements. Theories related to chemical bonding. Acid-base concept, pH, buffer. Factors responsible for reactivity of organic molecules. Basics and mechanism of chemical kinetics. Properties of electrolytes. |
| 2      | Qualitative & Quantitative Chemical analysis(Major) | S1-CHEM1P   | ✓     | ✓        | ✓        | ✓      | Importance of chemical safety and lab safety while performing experiments in laboratory, Qualitative inorganic analysis, Elemental analysis of organic compounds (non-instrumental) Qualitative identification of functional group of organic compounds Techniques of pH measurements Preparation of buffer solutions                                 |

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| 3 | Analytical Chemistry (Minor)                                             | S1-CHEM2T | ✓ | ✓ | ✓ | ✓ | Basic concepts of Mathematics for Chemists. Fundamentals of analytical chemistry and steps involved in analysis. Basic knowledge of Computer for chemists. Basic Concepts of Chemical equilibrium. Principles of Chromatography and chromatographic techniques. Various techniques of Spectroscopic Analysis                                                                                                                               |
| 4 | Analytical Processes and Techniques<br>Core Course/ Minor/<br>Elective – | S1-CHEM2P | ✓ | ✓ | ✓ | ✓ | Concepts and analytical methods in Chemistry. Preparation of solutions of different concentrations. Standardization of the solution. Identification of Organic compounds by chromatographic techniques. Analysis by Spectral Techniques.                                                                                                                                                                                                   |
| 5 | Chemistry in everyday life<br>(OpenElective)                             | S1-CHEM3T | ✓ | ✓ | ✓ | ✓ | Learn about the chemistry of ancient India. Ancient construction materials and discoveries.                                                                                                                                                                                                                                                                                                                                                |
|   |                                                                          |           | ✓ | ✓ | ✓ | ✓ | Gain information about acids, bases and salts involved in our day to day life. Have an idea of food adulteration, its harmful effects, and methods to detect adulteration and the important constituents of our food. Student will be familiar with the chemical nomenclature of the commonly used materials in daily life including toiletries, kitchen and beverages. Have an Elementary idea of disinfectants, pesticides and cleaners. |
| 6 | Chemistry in Everyday life                                               | S1-CHEM3P | ✓ | ✓ | ✓ | ✓ | Concepts and analytical methods in chemistry. Identification of acids, bases and salts involved in our day to day life. Methods to detect adulteration in commonly used food materials. Preparation of Natural indicator.                                                                                                                                                                                                                  |
| 7 | Reactions, Reagents and Mechanisms in Organic Chemistry (Major 1)        | S2-CHEM1T | ✓ | ✓ | ✓ | ✓ | Various organic reactions, reagents and their mechanisms, which will be helpful in understanding organic synthesis.<br>Application of the reactions in the various industries. like pharmaceutical, polymer, pesticides, textile, Dyes etc.<br>Important key reactions used in further study and Research work.                                                                                                                            |

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| 8  | Organic Qualitative Analysis, Reactions and synthesis (Major)                           | S2-CHEM1P | ✓ | ✓ | ✓ | ✓ | To perform various reactions, which will be helpful in Understanding organic synthesis. To use reagents to perform organic reactions. To perform rearrangement reactions. To prepare various organic compounds. To use chromatographic technique to monitor organic reactions. Applications of the reactions in the industries, e.g., pharmaceutical, polymer, pesticides, textile, dyes, etc. industries. These experiments will also be useful in further study and research work.                                      |
| 9  | Transition Elements, Chemi-energetics, Phase Equilibria (Core Course/ Minor/ Elective ) | S2-CHEM2T | ✓ | ✓ | ✓ | ✓ | Introductory idea about Traditional Indian Chemistry<br>Chemistry of d- & f-block Elements, Basic Concepts of Coordination Chemistry. Stereochemistry of Transition Metal Complexes. Laws of Thermodynamics. Concepts of Phase Equilibrium with reference to Solid Solution, Liquid-Liquid Mixtures, partially Miscible Liquids. Basic Concepts of Electrochemistry                                                                                                                                                       |
| 10 | Metal Complex Preparation, Thermochemical & Phase equilibria experiments                | S2-CHEM2P | ✓ | ✓ | ✓ | ✓ | Preparation of inorganic complexes. Use of calorimeter for thermochemistry experiments. Determination of enthalpy of various system and reactions. Experiments on phase equilibria. Construction of phase diagrams. Study of reaction equilibrium                                                                                                                                                                                                                                                                         |
| 11 | Generic Elective - Chemistry for Farmers                                                | S2-CHEM3T | ✓ | ✓ | ✓ | ✓ | Pro cultivation crop improvement soil and crop management for sustainable organic agriculture production and development. Physical properties of soil and fertilizers types, Soil types and soil structure required for an agricultural field. Analysis and identification of complex agricultural problems and formulating ethical solutions. Innovative processes products and technology to meet the challenges in agriculture and farming practices. Fundamentals of horticulture modern farming and organic farming. |

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| 12 | Green and Agriculture Chemistry             | S3-CHEM1D | ✓ | ✓ | ✓ | ✓ | Basic principle of green and sustainable chemistry. Understand stoichiometric calculation and relate them to green process metrics. Learn alternative solvent media green catalysis and energy sources of chemical processes. Understand the requirements of manures and fertilizers for various crops and their proper time of application. Understand to maintain soil fertility for better crop production.                                                                                                                                                                                                             |
| 13 | Green and Agriculture Chemistry             | S3-CHEM1Q | ✓ | ✓ | ✓ | ✓ | To learn green synthesis of organic and inorganic compound. To learn to prepare green ionic liquids. To understand soil profile sampling and study minerals present in soil. To learn to estimate organic matter content of soil.                                                                                                                                                                                                                                                                                                                                                                                          |
| 14 | Laboratory Skill, Techniques and Management | S3-CHEM2D | ✓ | ✓ | ✓ | ✓ | Familiarized with the basic facilities available in laboratories. To adopt appropriate disposal procedures and safety method suitable for laboratories. Expected to gain knowledge of the basic skill of organisation and management of science laboratories. Unable to expertise in the procedures to procurement and storage of laboratory equipment and materials. Trained in the operation and maintenance of simple instruments used in Science laboratories. Unable to develop skills in common laboratory techniques. Trained to adopt appropriate disposal procedures and safety method suitable for laboratories. |
| 15 | Exercise for development of lab skills      | S3-CHEM2Q | ✓ | ✓ | ✓ | ✓ | Preparation of standard solution. Determination of concentration. Determination of MP pH conductivity. Preparation of a stock solution. Preparation of various reagents.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 16 | Instrumental Techniques in Chemistry        | S3-CHEM3D | ✓ | ✓ | ✓ | ✓ | Preparation of standard samples for analysis. Determination of concentration of solution spectrometrically. Determination of stoichiometry and stability constant and complexes. Potentiometric and conductometric titrations. Advance chromatography techniques.                                                                                                                                                                                                                                                                                                                                                          |

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| 17 | Instrumental Techniques in Chemistry                     | S3-CHEM3Q | ✓ | ✓ | ✓ | ✓ | Preparation of standard samples for analysis. Determination of concentration of solution spectrometrically. Determination of stoichiometry and stability constant and complexes. Potentiometric and conductometric titrations. Advance chromatography techniques.                                                                                                                                                                                                                                                                                              |
| 18 | Bio Physical, Bio Inorganic and Organometallic Chemistry | S3-CHEM4D | ✓ | ✓ | ✓ | ✓ | Bio physical concepts like pH biological oxidation bioenergetics. Magnetic properties and electronic spectra of transition metal complexes. Structure and bonding analysis of organometallic compounds using the MO theory. Organometallic compounds of main group elements and their structure and bonding analysis. Bio Inorganic Chemistry and role of metal ions in biological systems.                                                                                                                                                                    |
| 19 | Synthesis and analytical techniques                      | S3-CHEM4Q | ✓ | ✓ | ✓ | ✓ | Synthesise of ferrocene from ferric chloride, potassium tries oxalate ferrate. Determine pH of bio sample; determine sugar in blood sample by photometry.                                                                                                                                                                                                                                                                                                                                                                                                      |
| 20 | pharmaceutical and medicinal chemistry                   | S3-CHEM2T | ✓ | ✓ | ✓ | ✓ | <i>Understand importance of pharmaceutical chemistry and pharmacopoeia. Learn intellectual property rights patents trademark and copyright. Understand definition classification of the drug with example and structures. Describe the structure activity relation of some important class of drugs. Describe the over all process of drug discovery and the role played by medicinal chemistry in this process. Relate the structure and physical properties of drugs to their pharmacological activity. Explain you chemical properties related to QSAR.</i> |
| 21 | pharmaceutical and medicinal chemistry                   | S3-CHEM2T | ✓ | ✓ | ✓ | ✓ | <i>Preparation of acetanilide. Isolate the caffeine from the tea leaves. To learn about preparation of simple syrup as per IP and USP. Morphology of turmeric, Ginger and mentha. Preparation of suspension emulsion on it means in organic separations pharmaceutical buffer solutions.</i>                                                                                                                                                                                                                                                                   |

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| 22 | Processing of fats and oils<br>(Generic elective) |         | ✓ | ✓ | ✓ |   | Gain knowledge about traditional Indian oil and traditional Indian oil processing methods.<br>Gain the knowledge about importance type natural resources of fats and oils and their effect on health.<br>Learn the method of refining and modification of fats and oils. Know about the nutritional aspects of fats and oils and their storage and handling.<br>Gain information regarding entrepreneurship in food processing and knowledge of local processing industries.                                                                                                                                   |
| 23 | Environmental toxicology(Generic elective)        |         | ✓ | ✓ | ✓ | ✓ | <i>Learn about definition and sources of toxicants. Learn about chemical toxicants biological toxicants and its assessment. Learn about different parts of ecotoxicology i.e. Immunotoxicology, Xenoviotics, neurotoxicology, bioaccumulation, biodegradation etc. Learn about the determination of acceptable risks and limits of environmental toxicants and utility of environmental benchmarks. Learn about environment al cytotoxicity and genotoxicity. Learn about what type of toxic chemicals affects in environment and solid West management. Learn about which factors influence the toxicity.</i> |
| 24 | Inorganic Chemistry                               | MCH 101 | ✓ | ✓ | ✓ | ✓ | Stereochemistry, bonding, VSEPR theory, MO treatment<br>Reaction mechanism of Substitution inertness and lability<br>Electronic spectra of transition metal complexes<br>Metal carbonyls, Dioxygen Complexes<br>Wilkinson's Catalyst, borane chemistry including topology, nomenclature, reactivity and bonding.                                                                                                                                                                                                                                                                                               |
| 25 | Organic Chemistry                                 | MCH 102 | ✓ | ✓ | ✓ | ✓ | Structure and bonding in organic molecules<br>Aromaticity, antiaromaticity, homo aromaticity including weaker bonds.<br>Stereochemistry, symmetry, chirality, optical activity and conformational analysis,<br>Reaction mechanism, Hammett equation, SN1, SN2 and SET mechanism,<br>UV-VIS, ORD & CD Spectroscopy                                                                                                                                                                                                                                                                                              |

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| 26 | Physical Chemistry      | MCH 103  | ✓ | ✓ | ✓ | ✓ | Schrodinger Wave equation, variation and perturbation theory,<br>Classical thermodynamics,<br>Phase rule, chemical dynamics, Arrhenius Equation,<br>Theory of reaction rate and application of rate law on dynamic chain reaction<br>Reaction catalysts                                          |
| 27 | Spectroscopy            | MCH 104  | ✓ | ✓ | ✓ | ✓ | Electromagnetic spectrum<br>Microwave spectroscopy<br>Infrared Spectroscopy<br>Raman and Electronic spectroscopy.<br>CARS (Coherent and Stokes Raman Spectroscopy) and application of these spectral techniques in structure determination of molecule.                                          |
| 28 | Mathematics for Chemist | MCH 105A | ✓ | ✓ | ✓ | ✓ | Basic concept of mathematical technique involved in Chemistry like Mathematics Algebra<br>Differential calculus, integral calculus,<br>Elementary differential equation<br>Permutation<br>Probability.                                                                                           |
| 29 | Biology for Chemist     | MCH 105B | ✓ | ✓ | ✓ | ✓ | Cell structure<br>Cell organs, and their function<br>Carbohydrates,<br>Lipids and fats, amino acids<br>Nucleic acids                                                                                                                                                                             |
| 30 | Inorganic Chemistry     | MCH 106  | ✓ | ✓ | ✓ | ✓ | Qualitative and Quantitative Analysis<br>Chromatography<br>Preparations- Preparation of selected inorganic complexes and their studies by measurements of decomposition temperature, molar conductance, IR and electronic spectra.                                                               |
| 31 | Organic Chemistry       | MCH 107  | ✓ | ✓ | ✓ | ✓ | Qualitative Analysis: Separation, purification and identification of compounds of binary mixture. Emphasis should be placed on physical principles, reaction chemistry and the technique involved in analysis.<br>Organic Synthesis- Purification of compounds by TLC and column chromatography. |

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|    |                     |         |   |   |   |   | Aromatic electrophilic substitutions, Reduction reaction<br><i>Quantitative Analysis</i> -Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method                                                                                                                                                                                   |
| 32 | Physical Chemistry  | MCH 108 | ✓ | ✓ | ✓ | ✓ | Adsorption<br>Phase Equilibria<br>Chemical Kinetics<br>Solutions                                                                                                                                                                                                                                                                                                                      |
| 33 | Inorganic Chemistry | MCH201  | ✓ | ✓ | ✓ | ✓ | Metal ligand equilibrium, reaction mechanism, base hydrolysis, conjugate base mechanism in octahedral and mechanism of square planar complexes.<br>Metal-ligand bonding<br>Calculations of Dq, B and beta parameters<br>Preparation, properties, structure and applications of metal nitrosyls.<br>Symmetry elements, symmetry operations and the principle involved in group theory. |
| 34 | Organic Chemistry   | MCH 202 | ✓ | ✓ | ✓ | ✓ | Mechanism- aromatic/aliphatic electrophilic substitution<br>Free radical, allylic halogenation reaction,<br>Addition to carbon-carbon and carbon-hetero atom multiple bond and aromatic nucleophilic substitution, SE1, SE2, SN1 SN2 & SRN1 reactions.<br>ESR Spectroscopy<br>IR and Raman spectra and their application in characterization of organic compounds                     |
| 35 | Physical Chemistry  | MCH 203 | ✓ | ✓ | ✓ | ✓ | Chemical dynamics<br>Adsorption and electrokinetic phenomenon, Micellization, DHO equation.<br>Lipmann electro-capillary phenomenon including different models.<br>Macromolecules and colloid including their types, emulsification, irreversible electrode phenomenon including decomposition voltage overlaps.                                                                      |

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| 36 | Spectroscopy & Diffraction Methods | MCH204  | ✓ | ✓ | ✓ | ✓ | Photoelectron spectroscopy, photoacoustic spectroscopy, X ray Diffraction, Neutron Diffraction. Biological cell, constituents, Bioenergetics Thermodynamics of biopolymer solution and transport of ion through the cell membrane.                                                                                                                                                                                                                                                    |
| 37 | Computer for Chemist               | MCH205  | ✓ | ✓ | ✓ | ✓ | Basic knowledge of computer and computing BASIC and FORTRAN based programming with especial reference to programming in chemistry. Rerunning of standard program in MS Word and MS Excel Search engines and various types of files like PDF, RTF, JPG OMR & Webcam.                                                                                                                                                                                                                   |
| 38 | Inorganic Chemistry                | MCH 206 | ✓ | ✓ | ✓ | ✓ | Chromatography Separation of cations and anions by Column Chromatography Estimation of Ni – Fe, Ni (Gravimetrically), Fe (Volumetrically) Preparations- Preparation of selected inorganic complexes and their studies by measurements of decomposition temperature, molar conductance, IR and electronic spectra.<br><i>Interpretation of TG and NMR spectra of some known compounds</i>                                                                                              |
| 39 | Organic Chemistry                  | MCH 207 | ✓ | ✓ | ✓ | ✓ | Qualitative Analysis: Separation, purification and identification of compounds of binary mixture. Emphasis should be placed on physical principles, reaction chemistry and the technique involved in analysis.<br>Preparation of phenyl azo – $\beta$ – naphthol from aniline.<br>Aromatic electrophilic substitutions, Reduction reaction<br><i>Quantitative Analysis</i> -Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method |

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| 40 | Physical Chemistry   | MCH 208 | ✓ | ✓ | ✓ | ✓ | Electrochemistry<br>Conductometry<br>Potentiometry/pH meter<br>Polarimetry                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 41 | Inorganic Chemistry  | MCH301  | ✓ | ✓ | ✓ | ✓ | Group theory, Character tables, orthogonality theorem, applications for C <sub>2v</sub> and C <sub>3v</sub> point groups<br>Correlation of vibrational spectroscopy with group theory. They will also understand molecular energy levels and M.O. Diagrams, bonding of multidentate ligands, characterization by IR & Raman spectroscopy.<br>Shift reagents in NMR spectroscopy<br>Structure and functioning of metalloenzymes e.g., carboxypeptidase, carbonic anhydrase<br>Structure and functioning of biomolecules like Hemoglobin. |
| 42 | Organic Chemistry    | MCH302  | ✓ | ✓ | ✓ | ✓ | Basic theory of NMR spectroscopy, applications to characterize organic compounds.<br>Photochemical reactions.<br>Mechanism of pericyclic reaction,<br>Woodward Haffmann, FMO & PMO approach<br>Sigma tropic rearrangements.                                                                                                                                                                                                                                                                                                             |
| 43 | Physical Chemistry   | MCH303  | ✓ | ✓ | ✓ | ✓ | Atomic concepts, Russell-Saunders terms and coupling. Molecular Orbitals, Huckel theory of conjugated systems like ethylene, butadiene<br>Homo and heterogeneous catalysis.<br>Crystal defects. Schottky and Frankel defects<br>Solid state reactions. Metallic bond<br>Conductors, semiconductors, insulators and superconductors                                                                                                                                                                                                      |
| 44 | Analytical Chemistry | MCH304B | ✓ | ✓ | ✓ | ✓ | Statistical Analysis., Sample Preparation for Chromatography.<br>Chromatography. Theory of Chromatography, Gas Chromatography, High-Performance Liquid Chromatography, Capillary Electrophoresis.<br>Ion Exchange, Solvent Extraction<br>Atomic Absorption Spectrometry, Electrolytic Methods<br>Acid-Base Titrations, Precipitation                                                                                                                                                                                                    |

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|    |                     |         |   |   |   |   | Titrations, Complexometric Titrations, Redox Titrations.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 45 | Photochemistry      | MCH304C | ✓ | ✓ | ✓ | ✓ | Photochemical Reactions<br>Determination of Reaction Mechanism<br>Photochemistry of Alkene<br>Photochemistry of Carbonyl<br>Miscellaneous Photochemical Reactions, Photo degradation of polymers. Photochemistry of vision.                                                                                                                                                                                                                                                    |
| 46 | Inorganic Chemistry | MCH306  | ✓ | ✓ | ✓ | ✓ | Synthesis<br>Synthesis of selected inorganic compounds and their studies by measurements of decomposition temperatures and molar conductance, magnetic and IR electronic spectra.<br>Qualitative test of suitable anion and determination of metal content gravimetrically in the above compounds.<br>Interpretation of ESR and mass spectra of some known coordination compounds.                                                                                             |
| 47 | Organic Chemistry   | MCH307  | ✓ | ✓ | ✓ | ✓ | Qualitative Analysis<br>Separation, purification and systematic identification of the components of a mixture of three organic compounds (solids and liquids). Preparation of one derivative of each compound. Use of TLC for ascertainment of purity of compounds.<br>Multi-step Synthesis<br>This exercise should illustrate the use of organic reactions/ diverse conditions and principles for organic synthesis. Purification of compounds by chromatographic techniques. |
| 48 | Physical Chemistry  | MCH308  | ✓ | ✓ | ✓ | ✓ | Potentiometry<br>Conductivity<br>Spectrophotometry<br>Molecular Modeling                                                                                                                                                                                                                                                                                                                                                                                                       |

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| 49 | Inorganic Chemistry           | MCH401 | ✓ | ✓ | ✓ | ✓ | ESR Spectroscopy<br>Mossbauer, IR, Raman spectroscopy,<br>Point groups and vibrational spectroscopy.<br>Bio-inorganic chemistry, chlorophyll, photo systems one and two,<br>Metalloproteins cytochromes, iron Sulphur protein, Nitrogen fixation.                  |
| 50 | Organic Chemistry             | MCH402 | ✓ | ✓ | ✓ | ✓ | <sup>13</sup> C NMR Spectroscopy, Mass spectroscopy.<br>Reaction mechanism of elimination, E1, E2 & E1CB type, Substitution reactions. Enzymes, structure and functioning.                                                                                         |
| 51 | Physical Chemistry            | MCH403 | ✓ | ✓ | ✓ | ✓ | NMR, ESR spectroscopy.<br>Laws of photochemistry, fluorescence,<br>Steric and conformational properties of molecules, Winstein-Holmer and Curtin-Hammett Equations<br>CO5: Electronic effects involved in SN1 and SN2 type of reactions, and curve crossing model. |
| 52 | Polymer Chemistry             | MCH404 | ✓ | ✓ | ✓ | ✓ | Basic theory, classification of polymers<br>Characterization, important properties of polymers<br>Commercial importance of polymers<br>Processing to understand different types of casting like die-rotational, film<br>Methods for designing variety of polymers  |
| 53 | Chemistry of Natural Products | MCH405 | ✓ | ✓ | ✓ | ✓ | <i>Terpenoids, Alkaloids, Steroids<br/>Plant Pigments. Carotenoid, Flavonoids, Chlorophyll, Vitamins and Antibiotics, Antibiotics.</i>                                                                                                                             |
| 54 | Inorganic Chemistry           | MCH406 | ✓ | ✓ | ✓ | ✓ | Spectrophotometric Determination<br>Flame photometric determination<br><br>Model Experiments on Cyclic Voltammetry<br>Interpretation of ESR, NMR and Thermogravimetric pre-recorded results of known compounds                                                     |
| 55 | Organic Chemistry             | MCH407 | ✓ | ✓ | ✓ | ✓ | Multi-step Synthèses - Qualitative & Quantitative<br>Quantitative Analysis<br>Spectral Analysis: Interpretation of pre-recorded UV-Vis, IR, NMR, Mass, Raman spectrum and characterization of one organic compound.                                                |

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| 56 | Physical Chemistry | MCH408 | ✓ | ✓ | ✓ | ✓ | Spectrophotometry<br>Chemical Kinetics<br>Electronics<br>Molecular Modeling |
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