Estd. June 1964

"Education for Knowledge, Science and Culture."
– Shikshanmaharshi Dr. Bapuji Salunkhe
Shri. Swami Vivekanand Shikshan Sanstha's
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)
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Department of Chemistry

Course Outcomes (COs): Chemistry

M.Sc. Part II Analytical Chemistry (NEP Introduced in the year 2024-25)	
Semester III	
DSC-V: Major Paper: Advanced Analytical Techniques (DSC16CHE31)	
CO No.	**On completion of the course, student will be able to:**
CO1	Understand mass spectrometry, encompassing its fundamental principles and advanced applications in scientific research. They will gain insights into the basic principles of mass spectrometry, including ionization, mass analysis, and detection. Additionally, they will be able to identify different types of mass spectrometry-based on the ion sources used and explain the function and principles of quadrupole mass analyzers.
CO2	Develop a comprehensive understanding of nanomaterials and nanotechnology, from fundamental concepts to advanced applications. Also understand the types of nanomaterials like 0D (quantum dots), 1D, 2D, and 3D and processes for synthesis of nanomaterials. Identify and describe the various applications of nanotechnology across fields such as medicine, electronics, environmental science, and energy.
CO3	Gain a thorough understanding of advanced instrumentation techniques, including their principles, instrumentation, and practical applications of SEM, TEM, AFM.
CO4	Acquire a comprehensive understanding of several key analytical methods used in chemistry and research Raman Spectroscopy, XFS, ESR, and XPS. They will also study the principle of Auger electron emission, instrumentation, and Secondary Ion Mass Spectrometry (SIMS).
DSC-VI: Major Paper: Organo Analytical Chemistry (DSC16CHE32)	
CO No.	**On completion of the course, student will be able to:**
CO1	Understand the UV-visible, IR, NMR, and mass spectrometry techniques. They will be also adept at interpreting spectra,

	determining molecular structures, and solving complex structural problems. Additionally, students will gain hands-on experience with spectroscopic instruments, enhance their critical thinking and data analysis skills, and effectively communicate their findings. The course also emphasizes ethical standards and safety protocols in analytical practices.
CO2	Gain a thorough understanding of drug classification and the various sources of impurities in pharmaceutical and vitamin raw materials, including chemical, atmospheric, and microbial contaminants.
CO3	Provide proficiency in analytical methods for analyzing blood, urine, and serum, including the estimation of glucose, cholesterol, urea, hemoglobin, bilirubin, uric acid, creatinine, calcium, phosphate, sodium, potassium, and chloride.
CO4	Understand the pesticides, including their classification, chemical properties, and mechanisms of action. Additionally, students will develop skills in forensic analysis techniques, enabling them to investigate and interpret evidence related to the presence and impact of pesticides in forensic contexts. The course will also cover the legal and regulatory aspects of pesticide use and forensic investigations, preparing students to apply their knowledge in real-world scenarios and contribute to environmental safety and justice.
DSE - IX: Elective Paper I: Electroanalytical Techniques In Chemical Analysis (DSE16CHE31)	
CO No.	**On completion of the course, student will be able to:**
CO1	Understand the theoretical principles and practical applications of voltammetry techniques, including cyclic, square wave, and differential pulse voltammetry. They will gain hands-on experience in performing these methods, interpreting voltammograms, and applying voltammetric techniques in various fields such as environmental monitoring and pharmaceuticals.
CO2	Understand the fundamental principles and properties of colloids and emulsions, including their stability and behavior in different environments. They will gain practical skills in preparing and characterizing colloidal and emulsion systems, and learn to apply these concepts in fields such as pharmaceuticals, cosmetics, and food science.

CO3	Understand the principles and techniques of particle size analysis, including methods such as laser diffraction, dynamic light scattering, and sieving. They will gain practical skills in performing and interpreting particle size measurements, and learn to apply these techniques in various industries such as pharmaceuticals, materials science, and environmental monitoring.
CO4	Understand the principles and applications of ion-selective electrodes and electrophoresis techniques. They will develop practical skills in using these methods for the analysis and separation of ions and biomolecules, and learn to apply these techniques in fields such as clinical diagnostics, environmental monitoring, and biochemistry.
DSE - X: Elective Paper II: Environmental Chemical Analysis And Control (DSE16CHE32) ..	
CO No.	**On completion of the course, student will be able to:**
CO1	Understand types of radioactive decay, natural decay series, nuclear models, nuclear properties, Mass energy, relationships, nuclear reactions, rates of radioactive decay, interaction of radiation with matter.
CO2	Explain nuclear structure and stability, define binding energy and mass defect and calculate each for a given nucleus; understand nuclear models to understand nuclear structure and their properties.
CO3	Identify and define various types of nuclear changes or processes including fission, fusion and decay reactions, to understand nuclear reactions and mechanism behind that.
CO4	Understand the basics of nuclear chemistry applications: nuclear power, nuclear reactor, medical treatment, isotopic labelling, and carbon dating.
Semester IV	
DSC-VII: Major Paper: Organic Industrial Analysis (DSC16CHE41)	
CO No.	**On completion of the course, student will be able to:**
CO1	Master in techniques for analyzing oils, fats, and soaps, including methods for determining composition, quality, and purity. They will also gain expertise in the analysis of detergents, understanding their chemical properties and performance characteristics, to apply these skills in quality control and product development.

CO2	Develop skills in analyzing food and food additives, including techniques for detecting and quantifying various components and contaminants. They will be equipped to ensure food quality and safety through effective analysis of ingredients, preservatives, and additives.
CO3	Gain expertise in analyzing cosmetic products, including methods for assessing their composition, safety, and efficacy. They will develop skills in detecting and quantifying active ingredients, preservatives, and potential contaminants to ensure product quality and regulatory compliance.
CO4	Master in techniques for analyzing paints, pigments, and petroleum products, including methods for identifying and quantifying their chemical components. They will develop the ability to assess product quality and performance, ensuring compliance with industry standards and regulatory requirements.
DSC-VIII: Major Paper: Advanced Methods In Chemical Analysis (DSC16CHE42)	
CO No.	**On completion of the course, student will be able to:**
CO1	Understand and apply the principles of fluorescence and phosphorescence spectrophotometry to analyze and interpret spectral data. They will also develop proficiency in using spectrophotometric techniques to investigate the photophysical properties of various materials and compounds.
CO2	Understand the theoretical foundations of kinetic methods of analysis, including techniques such as the Tangent Method, Fixed Time and Concentration method, and Addition Method. Additionally, they will gain proficiency in applying these methods to determine substance quantities, investigate oxidation reactions involving H_2O_2, and analyze enzyme-catalyzed reactions, including the effects of inhibitors and activators.
CO3	Comprehend and apply the basic principles of photoelectric effects and photoionization processes, including the interpretation of photoelectron spectra of simple molecules. They will also gain expertise in techniques such as ESCA, understanding chemical shifts, and Auger electron spectroscopy for analyzing material composition and electronic structure.
CO4	Understand the principles of X-ray generation, the properties of X-radiation, and the instrumentation used in X-ray analysis. They will also develop skills in applying X-ray absorption, fluorescence, and diffraction methods for various analytical

	applications.
DSE - XI: Elective Paper I: Applied Analytical Chemistry (DSE16CHE41)	
CO No.	**On completion of the course, student will be able to:**
CO1	Understand and utilize various spectrochemical methods, including electronic spectroscopy, NIR spectrometry, FTIR spectrometry, and fluorimetry, for the analysis of molecular structures and materials. They will also acquire practical skills in using optical sensors and conducting spectrometric analysis of Portland cement.
CO2	Gain a comprehensive understanding of foundry materials, including ferroalloys, special steels, slags, and fluxes.
CO3	Acquire the knowledge and techniques necessary for the chemical analysis of soil and fertilizers. They will be able to evaluate soil composition and fertility, as well as determine the nutrient content and quality of various fertilizers.
CO4	Perform detailed chemical analyses of explosive materials such as TNT, RDX, lead azide, and EDNA, as well as conducting polymers, resins, and rubber. They will also gain expertise in analyzing luminescent paints, lubricants, and adhesives to determine their composition and properties.
DSE - XII: Elective Paper II: Quality Assurance and Accreditation (DSE16CHE42)	
CO No.	**On completion of the course, student will be able to:**
CO1	Implement quality assurance principles and practices to ensure the reliability and accuracy of analytical results. They will also develop skills in developing, validating, and maintaining quality control procedures in various laboratory and industrial settings..
CO2	Create and manage comprehensive documentation to support quality assurance processes, ensuring compliance with industry standards and regulations. They will also develop proficiency in maintaining accurate records, performing audits, and utilizing documentation to enhance the overall quality management system..
CO3	Develop and manage detailed documentation essential for effective quality assurance, including standard operating procedures and quality control records. They will also gain skills in utilizing documentation to ensure compliance with regulatory standards and to support continuous improvement in quality management systems.
CO4	Understand the requirements and processes involved in

	achieving quality accreditation for organizations, including the implementation of relevant standards and guidelines. They will also develop the ability to prepare and manage documentation, conduct internal audits, and ensure ongoing compliance to maintain accreditation status.

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous)
ESTD JUNE 1964

HEAD
DEPARTMENT OF CHEMISTRY
VIVEKANAND COLLEGE, KOLHAPUR
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