Programme Outcome (PO):

The undergraduate (UG) course offered by the Department of Chemistry, Ramakrishna Mission Vivekananda Centenary College, Rahara, follows the CBCS syllabus prescribed by the UGC. The course is a combination of general and specialized education, simultaneously introducing the concepts of breadth and depth in learning. The fundamental aim of UGcourse is to produce competent chemists who can think and work independently in chemical laboratories or can fit themselves in chemical industries. They are also encouraged with benign and sustainable developments. The present curriculum will not only advance their knowledge and understanding of the subject, but will also increase the ability of critical thinking, development of scientific attitude, handling of different instruments, improve practical skills, enhance communication skill, social interaction, increase awareness in environment related issues and recognize the ethical value system. Additionally the training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry. Besides all these things the students are enlightened with value-education.

Programme Specific Outcomes (PSO):

The UG curriculum caters an all-round development of the student, rolling out globally ready individuals into the fast pacing world. The programme specific outcome includes:

- Understanding the nature and basic concepts of bonding in molecules, chemical behavior, stereochemistry of molecules and many interactions within the molecule and with other molecules, and application of different compounds in the field of material sciences, pharmaceutical and agricultural industries.
- The course will make them aware of natural resources and help them to make eco-friendly environment.
- Hands on training in various fields will develop practical skills, handling equipments and interpreting spectral data.
- Knowledge gained through theoretical and lab based experiments will generate technical personnel as analytical chemists, bench chemists for the laboratories and industries, instrument operators in chemical and biochemical laboratories.

Course Outcome (CO)	
Structure and Bonding in organic and inorganic compounds	On completion of the course, students will be able to: • Understand the different types of interactions present in molecules. • Know the actual three dimensional structure of molecules. • Understand VB and MO theories.
Chemistry of different functional groups and different types of reactions	On completion of the course, students will be able to: • Understand the reactivity of different organic molecules. • Know different important reactions those will help them to apply in the synthesis of different important compounds. • Understand the mechanism and importance of different reactions.
Stereochemistry	On completion of the course, students will be able to: • Know the actual shape of a molecule.

	• Know the different terminologies and their application in the higher field of chemistry. • Understand asymmetric synthesis. 50% of the total drugs we use are having a single enantiomer. Knowledge on asymmetric synthesis will help the students to get idea about it. • Know about chirality. Almost all enzymic reactions are chiral in nature. Knowledge on chirality will help to understand enzymic reactions.
Heterocyclic compounds	On completion of the course, students will be able to: • Know about different heterocyclic compounds of different sizes especially 5 and 6-membered heterocycles. • Know the synthesis and reactions of different heterocycles. • Understand many biological roles of some heterocycles.
Chemistry of Biomolecules	On completion of the course, students will be able to: • Know about carbohydrate, aminoacids, peptides, proteins and nucleic acids. • Know their structure, reactivity and function in living bodies. • Understand about specific functions of DNAs and RNAs. • Know chemical methods for sequencing biopolymers.
Natural products	On completion of the course, students will be able to: • Know about alkaloids and terpenoids. • Know their structure, reactivity and applications.
Spectroscopy	On completion of the course, students will be able to: • Understand the fundamental principles of different spectroscopies. • Know the application of different spectroscopy in characterizing different aspects of molecules. It may be related to the structure of molecule or may be related to specific properties of molecules. • Interpret different spectra. • Understand how trace amounts (micro level) of metal elements present in different samples can be identified or quantified by flame atomic spectroscopy.
Analytical methods	On completion of the course, students will be able to: • Know the basic concepts of analysis of different compounds and separation of different types of mixtures. • Understand different types of chromatography like column chromatography, TLC, Paper chromatography and ion-exchange chromatography. • Know their applications in different fields like in geochemistry, metallurgy etc.
Co-ordination Chemistry	On completion of the course, students will be able to: • Understand the colour, magnetic properties and chemical potentials of coordination compounds. • Understand the nature of geometry (stereochemistry) of complexes of a metal ions.

	• Understand the reaction mechanism
Organometallics Chemistry	On completion of the course, students will be able to: • Understand the different types of organic reactions involving carbon metal bonds. • Understand the role of metals in controlling the regio- and stereo- specificities of the reactions. • Realize the industrial application of organometallic chemistry. • Know the use of organometallic compounds in the fields of catalysis, medicine etc.
Periodic Table	On completion of the course, students will be able to: • Understand the nature of elements and their different properties, periodic variation of the properties etc.
Redox Chemistry	On completion of the course, students will be able to: • Understand the redox phenomenon of redox active substances and its applications in different fields
Acid Base Chemistry	On completion of the course, students will be able to: • Understand the acid-base behaviours of different organic and inorganic compounds. • Acquire the knowledge of pH in solution of compounds and hence the application in different fields.
Chemistry of Elements	On completion of the course, students will be able to: • Understand the chemistry of a variety of compounds of the s-block, p-block, d-block and f-block periodic elements. • Know the applications of these compounds in different industrial needs.
Radio-Nuclear Chemistry	On completion of the course, students will be able to: • Understand the radioactivity and related phenomena of radioactive atoms. • Know the versatile applications of radiochemistry in different fields like in determination of age of an ancient species, reaction mechanism through isotope labeling, in medicinal chemistry etc. • Understand the hazards of radiations and also know the safety measures.
Bio-inorganic Chemistry	On completion of the course, students will be able to: • Understand different aspects (structures and biological functions) of the biomolecules like the metalloproteins, metalloenzymes etc containing metal ions. • Know the different aspects like oxygen transport, electron transport, hydrolysis of peptides in vertebrates and invertebrates.
Photochemistry	On completion of the course, students will be able to: • Get elementary ideas about the fundamental laws governing the chemical reaction induced by light • Know the representation of various photo-physical processes by Jablonsky diagram.

	• Be accustomed with the different scientific nomenclature frequently used for further extensive studies of the subject.
Chemical Kinetics	On completion of the course, students will be able to: • Know how fast a chemical reaction can occur under certain physical conditions and what are the specific roles of different parameters affecting the speed or rate of any chemical reaction. • Understand the role of catalysts and biocatalyst (e.g. enzymes, etc.) in a catalyzed reaction. • Solve numerical problems and experimentally determine the order, rate and activation energy of a chemical reaction.
Surface phenomenon	On completion of the course, students will be able to: • Know about basic laws governing the adsorption; acquire an elementary idea about physisorption and chemisorptions. • Have an idea about different adsorption isotherms and their theoretical derivation, thermodynamic aspects of sorption processes, role and function of heterogeneous catalysts. • Solve numerical problems related to this topic and get a hands-on experience about the experiments related to physisorption.
Thermodynamics	On completion of the course, students will be able to: • Know that any system in the universe is governed by the laws of thermodynamics, be it a living cell or be it the solar system. • Get ideas about the principles/laws governing the physic-chemical behavior of a system • Know the application of thermodynamic principles for a system performing mechanical work and determination of change in internal energy, enthalpy, entropy, Gibbs free energy, Helmholtz free energy, etc. • Acquire knowledge about the application of laws of thermodynamics in case of chemical reactions and learn fundamental laws governing thermo-chemistry. • Get hands-on experience on determination of enthalpy of various physical and chemical processes.
Chemical Equilibrium	On completion of the course, students will be able to: • Learn about the conditions of chemical equilibrium and application of thermodynamic laws to explain chemical equilibrium; to derive reaction isotherm; equilibrium constants based on different standard states; dependence of equilibrium constants on temperature and pressure; derivation of van't Hoff reaction isotherm and reaction isochore; effect of various parameters governing the equilibrium position of a chemical reaction; Le Chatelier principle and its thermodynamic derivation.

	• Solve numerical problems related to this topic.
Statistical Thermodynamics	On completion of the course, students will be able to: • Understand the significance of this subject and will be able to appreciate the role it plays in bridging the two pillars of Physical Chemistry – Thermodynamics and Quantum Mechanics. • Understand the "inside out" approach of this subject and acquire the basic knowledge about ensemble, kinds of ensemble, partition function and significance of partition function and representation of different thermodynamic quantities in terms of partition function. • Get idea about classical statistical thermodynamics and Quantum statistics on an elementary level. • Understand the relation between entropy and arrangement of different particles in various energy levels at the atomic level. • Learn the mathematical derivation of Maxwell-Boltzmann distribution law and should be able to solve numerical problems related with this topic.
Ionic Equilibrium and Electrochemical Cell	On completion of the course, students will be able to: • Learn how to treat solutions containing ionic species thermodynamically; get an idea about activity and activity coefficient of various ionic species present in the solution; variation of activity coefficient with ionic strength. • Get semi-qualitative ideas about Debye-Huckel limiting law and its application and limitation. • Learn about various electrode processes; different types of electrodes; derivation of Nernst equation using laws of Thermodynamics; derivation of expression of EMF of an electrode and EMF of a cell using Nernst equation about the betterment of the materials. • Learn the application of potentiometric titration as analytical techniques and solving numerical problems related to this topic.
Quantum Chemistry	On completion of the course, students will be able to: • Acquire fundamental knowledge regarding Planck's hypothesis and quantization of energy level, historical chronology leading to the development of Quantum Mechanics, wave-particle duality of light and its consequences, explanation of several physical processes such as Black-body radiation, photo-electric effect, Compton effect, specific heats of solids, etc. • Know Schrodinger's wave equation (time-independent), several mathematical techniques viz. operator algebra and their application to determine the physical property of different model and real quantum mechanical system, such as particle in

	a box, simple harmonic oscillator, rigid rotor and one-electron system like hydrogen atom.
Kinetic Theory of Gas; Deviation from Ideal Behaviour and Real Gas	On completion of the course, students will be able to: • Learn kinetic model of an ideal gas. • Learn the variation of speed of the gas molecules and theoretical treatment of this by Maxwell distribution formula, to determine various physical parameters such as pressure, kinetic energy, root mean square velocity, kinetic energy distribution, etc. • Learn the theoretical basis of Equipartition principle and its limitation. • Get an idea about the deviation of ideal behavior of the real gas, formulation of different equation of states (viz. van der Waals equation, Dieterici equation, Barthelot equation) to explain the behavior of real gases under different condition and also their limitations.
Liquid State	On completion of the course, students will be able to: • Get a qualitative idea about the molecular-level structure of liquid state. • Learn about the surface tension and viscosity of liquid; their dependence on temperature and pressure; derivation of the mathematical laws/rules to determine experimentally the value of such properties. • Solve numerical problems involving surface tension and viscosity of a liquid. • Get a preliminary idea about liquid crystal.
Solid State	On completion of the course, students will be able to: • Get an idea about the specific heat of solids, Einstein and Debye theory related to it; Laws of Crystallography; x-ray diffraction as a technique to explore the atomic/molecular-level structure of a crystalline solid. • Learn Bragg's law and crystal planes; Miller indices; Idea about Bravais lattices and detailed discussion about cubic crystal system.
Inorganic materials of industrial importance	On completion of the course, students will be able to: • Know the constituents of glass, ceramics and cements. • Understand the functions of different constituents. • Think about the betterment of the composite materials which are used for buildings, bridges, racing car bodies, shower stalls, bathtubs, storage tanks, imitation granite and cultured marble sinks and countertops etc. • Develop scientific thoughts among themselves for developing some technology or product to fulfill specific purposes.

Chemistry of Nanomaterials	On completion of the course, students will be able to: • Know the wide aspect of types and synthesis of different nanomaterials • Understand their characterizations and applications in different fields like in catalysis, bio-medicinal fields etc.
Green Chemistry	On completion of the course, students will be able to: • Understand the source of environmental pollutions and their role in making a green world. • Know the use of alternative energy sources, renewable feedstock and innocuous solvents. • Understand the merits of using biodegradable materials and developing recyclable materials. • Know about the developments of biofuels, rightfit pigments, green oxidants healthier fats and oils etc.