



ST. WILFRED'S P.G. COLLEGE

(Affiliated to the University of Rajasthan)

MASTER OF SCIENCE

COURSE OUTCOMES

M.Sc. PREVIOUS (CHEMISTRY)

Paper 1: INORGANIC CHEMISTRY

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|------|--|
| CO1. | Understand multiplication tables, irreducible representations, orthogonality theorem. |
| CO2 | Students can analyse kinetics and mechanism of substitution reactions in octahedral Co (III) and square planar Pt (II) complexes. |
| CO3 | Able to analyse valence bond treatment of planar, tetrahedral and square planar hybrid orbitals. |
| CO4. | Able to understand preparation, properties, structure and applications of alkyl and aryls of Lithium, Beryllium, Magnesium, Aluminum, Mercury and Tin. |
| CO5 | Student will learn Walsh diagram, $d\pi-p\pi$ bonds, Bent's rule, Study free ions in tetrahedral, octahedral and square planar crystal fields, Orgel diagrams, Tanabe Sugano diagrams. |

Paper 2: ORGANIC CHEMISTRY

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|------|--|
| CO1. | Understand concept of aromaticity, anti aromaticity, nonaromaticity and homoaromaticity with examples. |
| CO2 | Able to learn interconversion of Fischer, Newman and Saw-Horse projections, configurational projections, R/S and E/Z. |
| CO3 | Student will learn stereochemistry of N, S and P containing organic compounds & understand elements of symmetry and chirality. |
| CO4. | They can understand basic principles of organic reaction mechanism and its determination. |
| CO5 | Students can analyse aromatic nucleophilic and electrophilic substitution reactions with mechanism. |

Paper 3: PHYSICAL CHEMISTRY

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| CO1. | Able to learn Hückle molecular orbital theory and its applications. |
| CO2 | They will understand importance of symmetry in quantum mechanics. |
| CO3 | Students can analyse electro kinetic phenomena such as electrophoresis and electro osmosis. |
| CO4. | Able to evaluate corrosion of metals and its mechanism. |
| CO5 | Able to differentiate between different theories of kinetics & solve questions basis on rates of different reactions. |

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Paper 4: SPECTROSCOPY AND SUSTAINABLE CHEMISTRY

| | |
|------|---|
| CO1. | Students able to study in details important concepts of UV-Visible spectroscopy and its role in structure elucidation of organic compounds. |
| CO2 | Students can understand important concepts of Infrared spectroscopy and its role in structure elucidation of organic compounds. |
| CO3 | They can evaluate Raman spectroscopy. |
| CO4. | Students can analyze diffraction methods (X-ray Electron diffraction Neutron diffraction) for structure determination. |
| CO5 | They can analyze selection rules and intensities of transition in the spectra of transition metal complexes. |

Paper 5: GREEN AND SUSTAINABLE CHEMISTRY

| | |
|------|--|
| CO1. | Able to convey the use of green synthetic methods in organic synthesis.. |
| CO2 | Able to learn the use of ultra sound and microwaves in organic synthesis. |
| CO3 | Able to understand the concept polymer supports and phase transfer catalysts in organic synthesis.. |
| CO4. | Students will understand the use of crown ethers and ionic liquids in organic synthesis. Examine the applications and environmental hazards of nanomaterials memorize the twelve basic principles of green chemistry |
| CO5 | They can remember the mechanisms involved in multi component reactions memorize the twelve basic principles of green chemistry. |

Paper 6: ANALYTICAL TECHNIQUES

| | |
|------|---|
| CO1. | Student can estimate the types of errors in chemical analysis. |
| CO2 | Student can apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.. |
| CO3 | Able to prepare standard solutions. Understand the fundamentals of analytical chemistry and steps of a characteristic analysis. |
| CO4. | Able to conduct acid base titrations, complex metric titrations and redox titrations . |
| CO5 | They can evaluate the analytical data in terms of statistics. |

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M.Sc. FINAL (CHEMISTRY)

Paper 1: Application of Spectroscopy, Photochemistry & Solid State Chemistry

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|------|---|
| CO1. | Understand the important concepts of UV-Visible spectroscopy and its role in structure elucidation of organic compounds. |
| CO2 | Able to defines thermal properties of phonons, heat capacity of phonons, density of states and density of states models of Debye and Einstein. Can explain free electron gas model and band models. |
| CO3 | Able to explain crystal systems, crystal planes and directions, Miller indices, diffraction of waves by crystals and Bragg's law. |
| CO4. | Students can understand photo physical kinetics of unimolecular and bimolecular processes and Stern-Volmer & fundamentals of photochemistry and laws governing it such as Beer Lambert law. |
| CO5 | They can describe and distinguish between radiative and non- radiative transitions with the help of Jablonski diagram. |

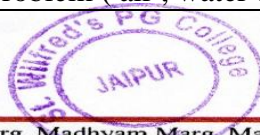
Paper 2: Bio inorganic Chemistry, Bio Organic Chemistry, Bio Physical Chemistry

| | |
|------|---|
| CO1. | Students can explain metal ion binding to biomolecules and their functions. |
| CO2 | Able to define importance of inorganic elements in vital systems .Determines and calculates association/dissociation constants and kinetic constants with the use of known physicochemical methods. |
| CO3 | Able to understand chemistry of cofactors and their biological function, mechanism, biosynthesis of nucleotides, folic acids; replication, transcription, protein biosynthesis. |
| CO4. | They can understand basic knowledge about biomolecules and their importance, application as well as mechanistic approach in relation to the conventional pathways. |
| CO5 | They will know principles of biophysical chemistry and their application in thermodynamic characterization and analysis of macromolecules. |

Paper 3: Environmental Chemistry

| | |
|------|--|
| CO1. | Students will retain information about the composition of air and the concepts of greenhouse effect and global warming. |
| CO2 | Students will know the different sources of water pollutants and to understand the Effects of water pollution. |
| CO3 | They can recognize the types and consequences of soil and radioactive pollutants. Discuss local and global environmental issues based on the knowledge gained throughout the course. |
| CO4. | They will scrutinize the causes and harmful effects of thermal and soil pollution. |
| CO5 | Students can apply basic chemical concepts to analyse chemical processes involved in different environmental problem (air , water & soil). |

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Paper 4: Organic Synthesis-I

| | |
|------|---|
| CO1. | Students will learn basic principles of organic reaction mechanism and its determination. |
| CO2 | Students will understand aromatic nucleophilic and electrophilic substitution reactions with mechanism. |
| CO3 | Able to understand mechanism and stereochemistry of elimination reactions. |
| CO4. | They can analyze oxidation & reduction reactions and their mechanism. Students will be able to understand the role of reagents and catalysts in organic synthesis |
| CO5 | Students will be able to analyze the difference in the basic types of synthetic approaches |

Organic Specialization

Paper 5: Organic Synthesis-II

| | |
|------|---|
| CO1. | Able to plan the various C-N and C-C bond reactions and predict the products. |
| CO2 | Able to solve chemo selective oxidation by using different oxidizing agents. |
| CO3 | They can understand reduction various functionalities by using different reducing agents. |
| CO4. | Students will know various synthetic methodologies to synthesis of various organic molecules. |
| CO5 | Able to analyze enantioselective and diastereoselective synthesis. Oxidizing and Reducing agents and their applications in organic synthesis. |

Organic Specialization

Paper 7: Chemistry of Natural Products

| | |
|------|--|
| CO1. | Understand different pathways of biogenesis of natural products. |
| CO2 | Students will know structure elucidation of terpenoids (camphor, abiotic acid, squalene). |
| CO3 | They will know structure elucidation of alkaloids (nicotine, quinine, morphine and reserpine). Learn the different types of alkaloids, glycosides & terpenes etc. and their chemistry and medicinal importance |
| CO4. | Able to learn advanced methods of structural elucidation of compounds of natural origin. |
| CO5 | Able to understand isolation, purification and characterization of simple chemical constituents from the natural source. |

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Inorganic Specialization

Paper 4: Organotransition Metal Chemistry

| | |
|------|--|
| CO1. | Students can be explain and rationalize the synthesis, structure, bonding, properties and reactivity of main group, transition metal, lanthanoid, and actinoid organyls. |
| CO2 | Students will get a good overview of the fundamental principles of organotransition-metal chemistry and know how chemical properties are affected by metals and ligands. |
| CO3 | They will be able to use knowledge about structure and bonding issues to understand the stability and reactivity of simple organometallic complexes. |
| CO4. | Able to work as a professional level in a chemical synthesis laboratory demonstrating effective laboratory safety and etiquette, especially in the areas of chromatographic techniques and spectroscopic characterization. |
| CO5 | They will understand fundamental reaction types and mechanisms and how to combine these to understand efficient catalytic processes. |

Inorganic Specialization

Paper 5: Bioinorganic & Supramolecular Chemistry

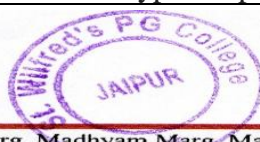
| | |
|------|--|
| CO1. | To enhance the abilities of learners to develop the concept of management accounting and its significance in the business. |
| CO2 | It enhances the abilities of learners to analyze the financial statements. Learn to analyse the linkage between auditing, accounting and financial statement analysis. |
| CO3 | To enable the learners to understand, develop and apply the techniques of management accounting in the financial decision making in the business corporates. |
| CO4. | To make the students develop competence with their usage in managerial decision making and control. |
| CO5 | Enables to express themselves and their ideas better than today in terms of technical points in accounting and auditing |

Inorganic Specialization

Paper 6: Photo inorganic Chemistry

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|------|---|
| CO1. | The student can formulate the macroscopic and quantum laws of the absorption of light by molecules and solids. |
| CO2 | The student will be able to describe the various deactivation processes of molecular excited states. |
| CO3 | The students will be able to characterize the kinetics of deactivation processes and their role in the photochemical reactivity. |
| CO4. | The student will be able to express the principles of photo polymerization and polymer photo degradation and stabilization. |
| CO5 | The student will be able to represent the mechanisms of natural photochemical processes & able to quote the various types of photochemical reactions. |

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Inorganic Specialization

Paper 7: Polymers

| | |
|------|---|
| CO1. | Remember the preparation and properties of some important polymers. |
| CO2 | Empathize the process of fabrication. |
| CO3 | Realize the applications of fiber and elastomer technology in the field of Industries. |
| CO4. | Able to explore the chemistry of elastomers. To study the methods of measuring the molecular weight, polymerization kinetics and copolymerization and polymer processing technologies.. |
| CO5 | To understand about radical and ionic polymerization and techniques of polymer analysis. |

Physical Specialization

Paper 4: Analytical Chemistry

| | |
|------|--|
| CO1. | Develops analytical skills and problem solving skills requiring application of Chemical principles. |
| CO2 | Apply appropriate techniques for the qualitative and quantitative analysis Of chemicals in laboratories and in industries. |
| CO3 | Understand the fundamentals of analytical chemistry and steps of a characteristic analysis. |
| CO4. | Able to apply conduct acid base titrations, complex metric titrations and redox titrations like permanganometry, dichrometry and iodometric-iodimetric Titrations. |
| CO5 | Able to evaluate the analytical data in terms of statistics. Compare qualitative and quantitative analysis methods. |

Physical Specialization

Paper 5: Physical Organic Chemistry

| | |
|------|---|
| CO1. | Students will be able to clearly communicate the results of scientific work in oral, written and electronic formats to both scientists and the public at large. |
| CO2 | Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems. |
| CO3 | Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments. |
| CO4. | Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in analytical, Inorganic, Organic and physical chemistry. Majors to be certified by the american chemical society will have extensive laboratory work and knowledge of biological chemistry. |
| CO5 | Students will be able to explore new areas of research in both chemistry and allied fields of science and technology. Students will be able to function as a member of an interdisciplinary problem solving team |

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Physical Specialization Paper 6: Chemical Dynamics

| | |
|------|--|
| CO1. | Able to compare and contrast the chemical behavior and reactions of common substances. |
| CO2 | Students can collect quantitative data and organize it into meaningful charts and graphs. |
| CO3 | Able to discuss industrial processes for manufacture of major inorganic chemicals. |
| CO4. | Analyze experimental data and draw appropriate conclusions from data and chemistry theories. |
| CO5 | Distinguish between a first-order reaction and a second-order reaction. Discuss the effect of a catalyst on a chemical reaction. |

Physical Specialization Paper 7: Electrochemistry

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| CO1. | Evaluate fundamentals of electrochemistry. |
| CO2 | Discuss electrode potentials and cell thermodynamics. |
| CO3 | Recognize the electrochemical processes. |
| CO4. | Evaluate electrodes and cells. |
| CO5 | Express the electrodes materials. Explain the type of electrodes and electrode materials. |

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COURSE OUTCOMES

M.Sc. PREVIOUS (MATHEMATICS)

Paper 1: Advanced Abstract Algebra

| | |
|------|---|
| CO1. | Familiarize extension fields, algebraic extensions. |
| CO2 | Understand geometric constructions finite fields. |
| CO3 | Acquire knowledge about Gaussian integers and multiplicative norms. |
| CO4. | The focus of the course will be the study of certain structures called groups, rings, fields and some related structures. |
| CO5 | Understand Galois theory and its applications. Helps to gain skill in problem solving and critical thinking. |

Paper 2: Real Analysis and Topology

| | |
|------|---|
| CO1. | Understanding and familiarize, functions of bounded variation, total variation, additive property of total variation and their properties. |
| CO2 | Familiarizing rectifiable path and arc length, additive and continuity properties of arc length, equivalence of paths and change of parameter. |
| CO3 | Attainment of a deeper and wider knowledge of sequence and series of functions and uniform convergence. |
| CO4. | Discuss several constructions of topological spaces and Analyse various properties of topological spaces. Apply properties of continuous functions on topological spaces. Examine connected, compact, and normal topological spaces and their properties and Demonstrate various theorems on Normal Topological spaces. |
| CO5 | Understand the concept Lebesgue outer measure, measurable sets, regularity, measurable functions, Borel and Lebesgue measurability. |

Paper 3: Differential equations and special functions

| | |
|------|--|
| CO1. | Explore the methods of solutions of boundary value problems. Investigate systems of ordinary differential equations. Model with first-order differential equations (DE) and identify initial value problem. |
| CO2 | Obtain solutions for ordinary differential equations whose non homogeneous terms Include discontinuous functions or distributions. |
| CO3 | Give an account of the foundations of calculus of variations and its applications in Mathematics and Physics. Describe the brachistochrone problem mathematically and solve it. Solve isoperimetric problems of standard type. |
| CO4 | Classify and explain the solution of Hyper geometrical differential equation. Understand purpose and application of ${}_2F_1(a,b;c,d)$ and Legendre's duplication formula. |
| CO5 | Understand nature and properties of various type special function like Bessel function ,Hermite polynomials and Laguerre polynomials. |

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Paper 4: Differential geometry and tensor analysis

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|------|---|
| CO1. | Explain the basic concepts about space curves, its arc length, tangents and normal. |
| CO2 | Compute evolutes and involutes of various space curves. |
| CO3 | Construct tangent plane, normal plane and osculating plane for space curves. Analyze the orthogonal trajectories and geodesics. |
| CO4. | Basic concept of Tensor analysis, Contravariant and Covariant tensors, relative tensor , metric tensor, permutation tensor. |
| CO5 | Christoffel symbol and their properties. Einstein space, flat space, isotropic point. Riemann- Christoffel tensor and its properties. |

Paper 5: Mechanics

| | |
|------|--|
| CO1. | Students will be able to articulate and describe relative motion, Inertial and non-inertial reference frames. Students will be able to define the motion of mechanical systems and their degrees of freedom. |
| CO2 | Able to understand an account of the foundations of calculus of variations and of its applications in mathematics and physics. |
| CO3 | Formulate maximum principles for various equations and derive consequences. |
| CO4. | Use the theory, methods and techniques of the course to solve problems. Study of the interaction of forces between solids in mechanical systems. |
| CO5 | Able to understand analytical mechanics as a systematic tool for problem solving. |

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M.Sc. FINAL (MATHEMATICS)

Paper 1: Functional Analysis

| | |
|------|---|
| CO1. | Learn the concept of normed linear spaces, Banach spaces and various properties operators defined on them. |
| CO2 | Discuss about the completion of normed linear spaces. |
| CO3 | Get an idea about different types of convergence of sequences in normed spaces and their relations. |
| CO4. | Demonstrate the consequences of Hahn-Banach theorem. Critique the closed graph theorem and stability result for operator. |
| CO5 | Understand that there is a surjective isometry between a Hilbert space and its dual. |

Paper 2: Viscous Fluid Dynamics

| | |
|------|---|
| CO1. | Understand about vortex motion and its permanence, rectilinear vortices, vortex images and specific types of rows of vortices |
| CO2 | Model mathematically the compressible fluid flow and describe various aspects of gas flow |
| CO3 | Acquire knowledge of viscosity, stresses and rates of strain and relation between them for newtonian fluids, energy dissipation due to viscosity, and laminar and turbulent flows. |
| CO4. | Derive the equations of motion for a viscous fluid flow and use them for study of flow of newtonian fluids in pipes and ducts for laminar flow fields, and their applications in mechanical engineering |
| CO5 | Get familiar with dimensional analysis and similitude, understand the common dimensional numbers of fluid dynamics along with their physical and mathematical significance, concept of boundary layer flow. |

Paper 3: Integral transformation and integral equations

| | |
|------|--|
| CO1. | Recognize the different methods of finding Laplace transforms and Fourier transforms of different functions. |
| CO2 | Recognize the contribution and impacts of functional analysis in applied science. |
| CO3 | Apply the knowledge of Linear Transform, Fourier Transform and Finite Fourier transforms in finding the solutions of differential equations, initial value problems and boundary value problems. |
| CO4. | Apply the various concepts of integral equations in various problems |
| CO5 | Able to select and combine the necessary laplace transform techniques to solve second-order ordinary differential equations. Discuss the solutions of various integral equations. |

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Paper 4: Relativity and cosmology

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|------|--|
| CO1. | Analyzing how to solve a problem by applying simple fundamental laws to more complicated situations. |
| CO2 | Develop tools to enable the quantitative calculation of general relativistic effects. |
| CO3 | Synthesize knowledge of Newtonian gravity and special relativity from the syllabus. |
| CO4. | Demonstrate understanding of the physics of space-time and its interaction with matter and light in the general theory of relativity, and contrast the theory with earlier descriptions of gravity. |
| CO5 | Apply physics knowledge and mathematical skills to solve problems, including applying the field equations with different metrics. Analyse gravitational phenomena in nature including black holes, wormholes, warp drives and the cosmological history of the Universe.. |

Paper 5: Advanced numerical analysis

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|------|--|
| CO1. | Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques. |
| CO2 | Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields |
| CO3 | Able to find roots of equations using iterative methods. |
| CO4. | Apply Gauss elimination method, Doolittle's decomposition method to solve problems. |
| CO5 | Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equations. |

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M.Sc. PREVIOUS (PHYSICS)

Paper 1: Classical mechanics and mathematical methods in physics

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|------|---|
| CO1. | Students learn Lagrangian and Hamiltonian and hence Lagrange and Hamilton's equation of motion and their application in different cases. |
| CO2 | Students learn small oscillations and its applications to different cases and hence determination of normal modes and normal frequencies. |
| CO3 | Students learn special theory of relativity, four vector, relativistic kinematics and their applications. |
| CO4. | Students study fluid dynamics, equation of continuity and Poiseuille's for streamline flow of a liquid through a capillary tube and its applications. |
| CO5 | Solve problems in orthogonality of vectors and Eigen values and Eigen vectors. |

Paper 2: Classical Electrodynamics


| | |
|------|--|
| CO1. | Students will have achieved the ability to use Maxwell equations in analyzing the electromagnetic field due to time varying charge and current distribution. |
| CO2 | Students will have achieved the ability to describe the nature of electromagnetic wave and its propagation through different media and interfaces. |
| CO3 | Students will have achieved the ability to explain charged particle dynamics and radiation from localized time varying electromagnetic sources. |
| CO4. | Students study the reflection and refraction of light when fall on the interface of different dielectric medium |
| CO5 | Students study about the propagation of light through conducting media and plasma. |

Paper 3: Quantum mechanics, atomic and molecular physics

| | |
|------|--|
| CO1. | To understand to solve the one dimensional Schrodinger wave equation . |
| CO2 | To verify the first order and second order perturbations theory. |
| CO3 | Able to analyze quantum state of electrons in atoms. Students learn about rotational and vibrational energy levels of diatomic molecules and Raman spectroscopy. |
| CO4. | Able to understand the microwave and infrared spectroscopy |
| CO5 | Understand the basic concept of NMR and ESR spectrometers. |


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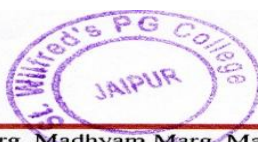
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Paper 4: Electronics, numerical methods and computer Programming

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|------|---|
| CO1. | Due to circuit analysis of IC and OPAMP, it will help in performing the mathematical Operation. |
| CO2 | Understand the basic electronics of logic circuits, counters, registers and be able to use Integrated circuit packages. Analyse the method for writing the C – programme for its algebraic equation |
| CO3 | Study the importance of Euler's method and Runge – kutta second and third Order and first order differential equation. |
| CO4. | Perform the theory and derivations for numerical differentiations and Integral. |
| CO5 | Be capable of specifying the simplified syntax of programming languages (C/C++). |

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M.Sc. FINAL (PHYSICS)

Paper 1: Advanced Quantum Mechanics and Introductory quantum field

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|------|---|
| CO1. | Apply Feynman rules to calculate probabilities for basic electromagnetic processes with particles (decay and scattering). |
| CO2 | Understand the basics of quantum electrodynamics and introduction to QCD. |
| CO3 | Discuss the difficulties with the theory of quantum measurement and local realism. |
| CO4. | Model physical systems using common approximation techniques for making dynamical calculations. |
| CO5 | Apply renormalization and regularization with quantum field theory. Get knowledge about gauge theories as well as quantum electrodynamics and quantum chromodynamics. |

Paper 2: Nuclear Physics


| | |
|------|--|
| CO1. | To study the various types of accelerator and nuclear fission and fusion.. |
| CO2 | Study the various types of nuclear reactors. Explain the experimental evidence for quarks, gluons, quark confinement, asymptotic Freedom, sea quarks, the running coupling constant and color charge |
| CO3 | To study the various types of accelerator and nuclear fission and fusion. |
| CO4. | Determine nuclear properties such as binding energy, spin and parity in the Framework of the liquid drop model and the shell model of the nucleus. |
| CO5 | Use the liquid drop model and the law of radioactive decay to describe alpha-decay, Beta-decay, fission and fusion, predict decay reactions and calculate the energy Release in nuclear decays. |

Paper 3: Statistical and solid state physics

| | |
|------|---|
| CO1. | Study the basic ideas of Bose-Einstein and Fermi –Dirac distribution. |
| CO2 | Apply the machinery of statistical mechanics to the calculation of macroscopic Properties Resulting from microscopic models of magnetic and crystalline systems. |
| CO3 | Define and discuss the concepts and roles of entropy and free energy from the view Point of statistical mechanics. |
| CO4. | Find out the relationship between crystals detector, structure analysis by Various methods. Understand the energy levels and define electrical conductivity – Hall Effect and free electron model and band gap energy |
| CO5 | Analyse the relationship between dielectric and Ferro electric proportion of Crystal |


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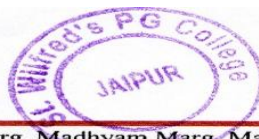
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Paper 4: Microwave Electronics

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|------|---|
| CO1. | Integrating a wide range of microwave components into one design oriented frame work. |
| CO2 | Characterize microwave devices in terms of the directionality of communication. |
| CO3 | Use a microwave test bench in analyzing various types of microwave measurements. |
| CO4. | Measure the various parameters in microwave engineering. Design & analyze the micro wave integrated circuits. |
| CO5 | An in-depth knowledge of applying the concepts on real time applications. |

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M.Sc. PREVIOUS (ZOOLOGY)

Paper 1: Biosystematics and Taxonomy

| | |
|------|--|
| CO1. | Learn the concept and principles of taxonomy, biosystematics and process of biological evolution. |
| CO2 | Understand the insect classification, apterygote orders. |
| CO3 | Understand the exopterygote orders and the endopterygote orders. |
| CO4. | Understand the ecology and behavior of Aquatic insects. |
| CO5 | Understand the ecology of Gall forming and Leaf mining insects, co evolution and social organization in insects. |

Paper 2: STRUCTURE AND FUNCTION OF INVERTEBRATES

| | |
|------|--|
| CO1. | Classify and characterize phylum-Protozoa and phylum-Porifera. |
| CO2 | Classify and characterize phylum-Coelenterate and phylum-Platyhelminthes. |
| CO3 | Introduction to Coelomates and Annelida. |
| CO4. | Introduction to Arthropod, Mollusca and Echinodermata. |
| CO5 | Course will provide knowledge regarding the various invertebrates species. |

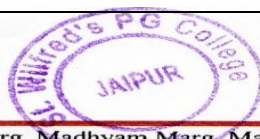
Paper 3: MOLECULAR BIOLOGY AND BIOTECHNOLOGY

| | |
|------|---|
| CO1. | Understanding of cloning of mammals, Large scale culture and production from recombinant microorganisms. |
| CO2 | Gains skills in medical, environmental biotechnology, bio pesticides, biotechnology of aquaculture and use of animals as bioreactors. |
| CO3 | This insight allows students to take into consideration about ethical issues involved In production transgenic animals and BT products. |
| CO4. | Learning application of molecules in modifying organisms and cells & understand of in vitro culturing of organisms and production of transgenic animals |
| CO5 | Able to learn basic molecular biological techniques to manipulate DNA, RNA and proteins. |

Paper 4: GENERAL PHYSIOLOGY

| | |
|------|--|
| CO1. | Compare the functioning of organ systems across the animal world. |
| CO2 | Explain the physiological functions of various organ systems of the mammalian physiology. |
| CO3 | Comprehend the study of endocrine system their role in maintaining homeostasis of the human body. |
| CO4. | Explain the patho-physiology of common diseases related to organ systems of the body. |
| CO5 | Discuss about clinically important diagnostic instruments, their working principle and applications. |

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Paper 5: BIOCHEMISTRY

| | |
|------|--|
| CO1. | Able to understand concept about structure and function about biological macromolecules essential to life. |
| CO2 | To make understanding about different monomeric units their source, structure, function in different biological systems. |
| CO3 | Concept of biosynthesis, bioenergetics, metabolism and biotransformation of individual biomolecules. Understanding the role of biomolecules in the functioning of cell as a whole and interlinking of various pathways related to biosynthesis, bioenergetics, metabolism and biotransformation. |
| CO4. | Understanding the corelationship that exists between structure and function of individual biomolecules. |
| CO5 | Understanding the bioenergetics and metabolism of different biomolecules. |

Paper 6: BIOSTATISTICS AND POPULATION GENETICS

| | |
|------|---|
| CO1. | Students gains knowledge about statistical Methods like measures of central Tendencies, Probability |
| CO2 | Students gain knowledge about various tools And techniques used in biological systems And gives them insight about their use in Research. |
| CO3 | Biostatistics teaches them to use the best data Analysis methods in their research projects. |
| CO4. | Students gains knowledge about statistical Methods like measures of central tendencies, Probability. |
| CO5 | Learns the problem-solving methods. |

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M.Sc. FINAL (ZOOLOGY)

Paper 1: Biology of Chordates

| | |
|------|--|
| CO1. | Concept and definition of the Chordate group. |
| CO2 | Evolution and functional relationships of particular Organ/structure/feature. |
| CO3 | Interlinking different strata of organizations of the Chordate Tissue/Organ systems. |
| CO4. | To analysis the diversity of functions and their relations with The environment. |
| CO5 | Understanding the structure-function relationship in the Vertebrate systems. |

Paper 2: Environmental Biology and Ethology

| | |
|------|--|
| CO1. | Understand the concepts of ethology. |
| CO2 | Elucidate the evolutionary aspects and adaptiveness of behaviour. |
| CO3 | Illustrate the hormonal regulation of behaviour. |
| CO4. | Describe the characteristics of population; growth and regulation of human Population. |
| CO5 | Compare the major terrestrial biomes and biogeographical zones of India. |

Paper 3 Genes and differentiation

| | |
|------|---|
| CO1 | Understanding genetics and relate modern DNA technology for disease diagnostics and therapy. |
| CO2 | Learn about DNA, RNA and their replication, mutations, DNA repair mechanism. |
| CO3 | Learn the molecular aspects of Genetics disorders and mutations. |
| CO4. | Appreciate the concepts of gene and relationship between genotype and phenotype. |
| CO5 | Helps in Highlighting the scope and significance of genetics by imbibing the principles of hereditary genetic transmission and interactions of gene with environment. |

PAPER IV -- Tools and Techniques

| | |
|------|---|
| CO 1 | Various techniques used in biological sciences |
| CO 2 | Types of Microscope and their use.As Microscopes are the eye into the living cell. |
| CO 3 | Principles and use of analytical instruments: centrifugae, spectrophotometer, pH meter. |
| CO 4 | Chromatography and its types, Electrophoresis, |
| CO 5 | The course imparts education in various techniques used in biological sciences. |

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PAPER V - Environmental Biology

| | |
|------|---|
| CO 1 | The course acts as an eye opener and let students use the interdisciplinary approaches such as ecology, economics, ethics and policy to devise solutions to environmental problems. |
| CO 2 | The subject makes students proficient in ecological field methods such as wildlife survey, biodiversity assessment, mathematical modeling and monitoring of ecological systems. |
| CO 3 | The subject enable the learners to understand how humans interact with the environment, and to find ways to deal with environmental problems and live more sustainably. |
| CO 4 | The course makes the environmental science students to study and take home the message of , how the environment interacts biologically, chemically and physically. |
| CO 5 | The course enables the students to strike balance between the natural environment, built environment, and the sets of relationships between them. |

PAPER VI - Environmental Toxicology

| | |
|------|---|
| CO 1 | Understand toxicology and associated terms related with environmental Toxicology. |
| CO 2 | The course enables the students to be familiar with toxicity episode phases and basic understanding of risk assessment. |
| CO 3 | Couse enables them to appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving. |
| CO 4 | The course enables the learner to understand environmental toxicology students to study toxic pollutants and their effects on the physical and biological environment, such as identifying and investigating potential sources of pollutants in the environment and minimizing their toxic effects on humans and other organisms. |
| CO 5 | Course imparts knowledge on toxic pollutants in the environment include different organic and inorganic chemical compounds, such as pesticides, industrial waste and heavy metals. |

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M.Sc. PREVIOUS(EVS)

Paper I: Ecology

| | |
|------|---|
| CO1. | Develop an appreciation of the modern scope of scientific inquiry in the field of Ecology |
| CO2 | Become familiar with the variety of ways that organisms interact with both the physical and the biological environment. |
| CO3 | Develop an understanding of the differences in the structure and function of different types of ecosystems. |
| CO4 | Learn techniques of data analysis as well as methods of presenting scientific information in figures and tables |
| CO5 | Develop an appreciation of the natural world through direct experience with local ecosystems. |

Paper II: Ecosystem

| | |
|------|--|
| CO1. | Understand ecosystem structure and functions |
| CO2 | Understand the ecosystem disruption. |
| CO3 | To understand local ecological issues. |
| CO4 | To understand basic methods of experimental design and analysis. |
| CO5 | Learn techniques for gathering data in the field. |

Paper III: Environmental Pollution and Health

| | |
|------|---|
| CO1. | To provide general understanding of quality of air, water and land and their pollutions. |
| CO2 | To provide the knowledge of impact of air and other pollutions on locals and global effects of air pollution on human, materials, properties and vegetation |
| CO3 | To study the fate and transport of air pollutants and its measurement techniques. |
| CO4 | To discuss the various types of air pollution control equipment and their design principles and limitation. |
| CO5 | To make people aware, and spread awareness in the industries that cause various pollution like water, air, soil, and noise and affect the environment and obviously health. |

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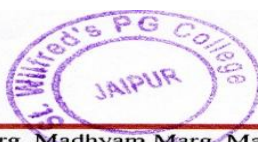
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Paper IV: Environmental Education and Policy

| | |
|------|--|
| CO1. | To increase public awareness about environmental issues |
| CO2 | To explore possible solutions, and to lay the foundations |
| CO3 | To provide active participation of individuals in the protection of environment |
| CO4 | To give the knowledge of Local, national and international legislative controls to protect and manage the environment; |
| CO5 | To familiarize the concept and scope of environmental law |

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M.Sc. FINAL(EVS)

Paper I: Waste Treatment and Management

| | |
|------|---|
| CO1. | To Minimize the Production of Waste. |
| CO2 | To Reduce Pollution Effects. |
| CO3 | To Protect Groundwater Sources. |
| CO4 | To Ensure Sustainability. |
| CO5 | To characterize the waste and apply the knowledge of laws for municipal solid waste management, for handling of biomedical wastes and for handling of plastic wastes. |

Paper II: Natural Resources and Biodiversity Conservation

| | |
|------|---|
| CO1. | To explore possible solutions, and to lay the foundations |
| CO2 | To increase public awareness about environmental issues and To provide resources for future generations |
| CO3 | To provide active participation of individuals in the protection of environment |
| CO4 | To protect and preserve the flora and fauna to main the balance in the ecosystem. |
| CO5 | To maintain ecological diversity |

Paper III: Environmental impact assessment and sustainable development

| | |
|------|---|
| CO1. | To identify, predict, and evaluate economic, environmental, and social impacts of development activities. |
| CO2 | To Providing information on the environmental consequences for decision making. |
| CO3 | To study the importance of EIA.. |
| CO4 | To know the role of public in EIA studies |
| CO5 | To Understand phenomena of impacts in the environment. |

Paper IV: Environmental Pollution Management and control Technology

| | |
|------|---|
| CO1. | To assess pollution sources. |
| CO2 | To study exposure pathways and fate . |
| CO3 | To provide active participation of individuals in the protection of environment |
| CO4 | To evaluate consequences of human exposure to pollution and its impacts to environmental quality. |
| CO5 | To take necessary steps to remediate reduce/eliminate pollution of the environment, |

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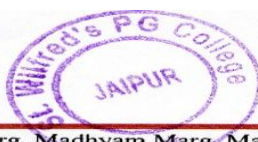
(Affiliated to the University of Rajasthan)

Paper V: Environmental Science, Ecological Principles, wildlife and conservation Biology

| | |
|------|---|
| CO1. | To assess pollution sources. |
| CO2 | To study exposure pathways and fate . |
| CO3 | To provide active participation of individuals in the protection of environment |
| CO4 | To evaluate consequences of human exposure to pollution and its impacts to environmental quality. |
| CO5 | To take necessary steps to remediate reduce/eliminate pollution of the environment. |

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M.Sc. PREVIOUS(BOTANY)

Paper 1: Cell and Molecular Biology of Plants

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Cell and Molecular Biology of Plants |
| CO2 | To enable the students to apply the basic concepts of Cell & Molecular Biology, and allied aspects of Cell & Molecular Biology of Plants |
| CO3 | Students are enabled with the understanding in the practical applications of Cell & Molecular Biology of Plants |
| CO4. | The student will get thorough knowledge on the Cell & Molecular Biology of Plants practice prevailing in Cell & Molecular Biology and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Cell & Molecular Biology of Plants |

Paper 2: Cytology, Genetics & Cytogenetics

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Cytology, Genetics & Cytogenetics |
| CO2 | To enable the students to apply the basic concepts of Cytology, Genetics & Cytogenetics, and allied aspects of Cytology, Genetics & Cytogenetics |
| CO3 | Students are enabled with the understanding in the practical applications of Cytology, Genetics & Cytogenetics |
| CO4. | The student will get thorough knowledge on the Cytology, Genetics & Cytogenetics practice prevailing in Cytology, Genetics & Cytogenetics and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Cytology, Genetics & Cytogenetics |

Paper 3: Biology & Diversity of Lower Plants: Cryptogams

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Biology & Diversity of Lower Plants: Cryptogams |
| CO2 | To enable the students to apply the basic concepts of Biology & Diversity of Lower Plants: Cryptogams, and allied aspects of Biology & Diversity of Lower Plants: Cryptogams |
| CO3 | Students are enabled with the understanding in the practical applications of Biology & Diversity of Lower Plants: Cryptogams |
| CO4. | The student will get thorough knowledge on the Biology & Diversity of Lower Plants: Cryptogams practice prevailing in Biology & Diversity of Lower Plants: Cryptogams and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Biology & Diversity of Lower Plants: Cryptogams |

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Paper 4: Taxonomy & Diversity of Seed Plants

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Taxonomy & Diversity of Seed Plants |
| CO2 | To enable the students to apply the basic concepts of Taxonomy & Diversity of Seed Plants, and allied aspects of Taxonomy & Diversity of Seed Plants |
| CO3 | Students are enabled with the understanding in the practical applications of Taxonomy & Diversity of Seed Plants |
| CO4. | The student will get thorough knowledge on the Taxonomy & Diversity of Seed Plants practice prevailing in Taxonomy & Diversity of Seed Plants and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Taxonomy & Diversity of Seed Plants |

Paper 5: Plant Physiology & Metabolism

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Plant Physiology & Metabolism |
| CO2 | To enable the students to apply the basic concepts of Plant Physiology & Metabolism, and allied aspects of Plant Physiology & Metabolism |
| CO3 | Students are enabled with the understanding in the practical applications of Plant Physiology & Metabolism |
| CO4. | The student will get thorough knowledge on the Plant Physiology & Metabolism practice prevailing in Plant Physiology & Metabolism and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Plant Physiology & Metabolism |

Paper 6: Microbiology and Plant Pathology

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Microbiology and Plant Pathology |
| CO2 | To enable the students to apply the basic concepts of Microbiology and Plant Pathology, and allied aspects of Microbiology and Plant Pathology |
| CO3 | Students are enabled with the understanding in the practical applications of Microbiology and Plant Pathology |
| CO4. | The student will get thorough knowledge on the Microbiology and Plant Pathology practice prevailing in Microbiology and Plant Pathology and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Microbiology and Plant Pathology |

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M.Sc. FINAL(BOTANY)

Paper 7: Plant Morphology, Development Anatomy & Reproductive Biology

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Plant Morphology, Development Anatomy & Reproductive Biology |
| CO2 | To enable the students to apply the basic concepts of Plant Morphology, Development Anatomy & Reproductive Biology, and allied aspects of Plant Morphology, Development Anatomy & Reproductive Biology |
| CO3 | Students are enabled with the understanding in the practical applications of Plant Morphology, Development Anatomy & Reproductive Biology |
| CO4. | The student will get thorough knowledge on the Plant Morphology, Development Anatomy & Reproductive Biology practice prevailing in Plant Morphology, Development Anatomy & Reproductive Biology and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Plant Morphology, Development Anatomy & Reproductive Biology |

Paper 8: Plant Ecology

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Plant Ecology |
| CO2 | To enable the students to apply the basic concepts of Plant Ecology, and allied aspects of Plant Ecology |
| CO3 | Students are enabled with the understanding in the practical applications of Plant Ecology |
| CO4. | The student will get thorough knowledge on the Plant Ecology practice prevailing in Plant Ecology and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Plant Ecology |

Paper 9: Plant Resource Utilization & Conservation

| | |
|------|---|
| CO1. | To enable the students to remember principles and concepts of Plant Resource Utilization & Conservation |
| CO2 | To enable the students to apply the basic concepts of Plant Resource Utilization & Conservation, and allied aspects of Plant Resource Utilization & Conservation |
| CO3 | Students are enabled with the understanding in the practical applications of Plant Resource Utilization & Conservation |
| CO4. | The student will get thorough knowledge on the Plant Resource Utilization & Conservation practice prevailing in Plant Resource Utilization & Conservation and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Plant Resource Utilization & Conservation |

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Paper 10: Biotechnology & Genetic Engineering of Plants & Microbes

| | |
|------|--|
| CO1. | To enable the students to remember principles and concepts of Biotechnology & Genetic Engineering of Plants & Microbes |
| CO2 | To enable the students to apply the basic concepts of Biotechnology & Genetic Engineering of Plants & Microbes, and allied aspects of Biotechnology & Genetic Engineering of Plants & Microbes |
| CO3 | Students are enabled with the understanding in the practical applications of Biotechnology & Genetic Engineering of Plants & Microbes |
| CO4. | The student will get thorough knowledge on the Biotechnology & Genetic Engineering of Plants & Microbes practice prevailing in and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Biotechnology & Genetic Engineering of Plants & Microbes |

Paper 11: Advanced Plant Pathology I

| | |
|------|--|
| CO1. | To enable the students to remember principles and concepts of Advanced Plant Pathology I |
| CO2 | To enable the students to apply the basic concepts of Advanced Plant Pathology I, and allied aspects of Advanced Plant Pathology I |
| CO3 | Students are enabled with the understanding in the practical applications of Advanced Plant Pathology I |
| CO4. | The student will get thorough knowledge on the Advanced Plant Pathology I practice prevailing in and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Advanced Plant Pathology I |

Paper 12: Advanced Plant Pathology II

| | |
|------|--|
| CO1. | To enable the students to remember principles and concepts of Advanced Plant Pathology II |
| CO2 | To enable the students to apply the basic concepts of Advanced Plant Pathology II, and allied aspects of Advanced Plant Pathology II |
| CO3 | Students are enabled with the understanding in the practical applications of Advanced Plant Pathology II |
| CO4. | The student will get thorough knowledge on the Advanced Plant Pathology II practice prevailing in and other allied aspects. |
| CO5 | To find out the technical expertise in maintaining the books of Advanced Plant Pathology II |

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M.Sc. PREVIOUS (GEOLOGY)

Paper I: Mineralogy, crystallography and Geo chemistry.

| | |
|------|--|
| CO1. | The students will be able to understand the evolution of the early Earth from protoplanetary material and its differentiation to present day state |
| CO2 | Further this will provide the foundation for other branches of earth sciences |
| CO3 | It will also help in gaining insight as to how geochemical processes operate within the earth |
| CO4 | Using advanced techniques, the students will be able to better understand the atomic configuration of various mineral families. |
| CO5 | The physical properties of minerals are also discussed along with their paragenesis. |

Paper II: Environmental geology, geomorphology and hydrology.

| | |
|-----|--|
| CO1 | To identify and define about soil resources |
| CO2 | To have a practical knowledge in management of soil |
| CO3 | To know different processes that exist in underground soil |
| CO4 | To describe and explain about soil formations |
| CO5 | The students will be able to describe scientific method applied in earth sciences. |

Paper III: Structural geology and tectonics.


| | |
|------|--|
| CO1. | The student can interpret and evaluate different structures that exist in the earth. |
| CO2 | Can critically assess and review the energy needed to cause different structures. |
| CO3 | Can describe and explain major and minor structures. |
| CO4 | Can understand to compare and contrast structures related to each other. |
| CO5 | Can evaluate and explain the causes of different structures |

Paper IV: Palenteology

| | |
|-----|---|
| CO1 | The students can understand the basic characteristics of minerals and occurrence. |
| CO2 | Can display knowledge in practical activities |
| CO3 | Can enumerate and compare between the diversity. |
| CO4 | Can recognize about environmental aspects regarding the occurrence of certain fossils |
| CO5 | Can draft a method for certain investigations. |


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Paper V: SEDIMENTOLOGY AND PRINCIPLE OF STRATIGRAPHY

| | |
|-----|---|
| CO1 | The main objective is to Recall and Review the Stratigraphy of India. |
| CO2 | To understand and explain different applications of Stratigraphy, like, Lithostratigraphy, Chronostratigraphy, Biostratigraphy, Sequence Stratigraphy, Chemostratigraphy and Magnetostratigraphy. |
| CO3 | To interpret utilizing different applications of sedimentology. |
| CO4 | Recognize the importance of critically assessing different approaches in Stratigraphy |
| CO5 | To conceptualize and conceive the necessity of Stratigraphy |

Paper VI: PRECAMBRIAN GEOLOGY AND STRATIGRAPHY OF INDIA

| | |
|-----|--|
| CO1 | Students will able to know about the various concepts of paleontology |
| CO2 | Students will understand about the origin and evaluation of life |
| CO3 | Students will able to interpret the succession of vertebrate life through geologic time and broad classification and study of some characteristic Indian vertebrate genera |
| CO4 | Students will able to differentiate the morphology, classification, evolutionary trend, composition and structure of shells of selected groups of organisms |
| CO5 | Students will able to know the concept of the sampling methods and sample processing techniques and the application of micropaleontology in hydrocarbon exploration. |

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M.Sc. FINAL (GEOLOGY)

Paper I: Resource Geology

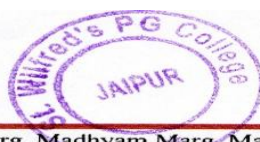
| | |
|-----|---|
| CO1 | The student is introduced to the detailed study, identification, recognition, uses and applications of the ore deposits related to PGE, Gold, Iron, Manganese, and Chromium. |
| CO2 | The student is introduced to the detailed study, identification, recognition, uses and applications of the ore deposits related to Vanadium, Molybdenum, Tungsten, Nickel, Cobalt, Titanium. |
| CO3 | The student is introduced to the detailed study, identification, recognition, uses and applications of the ore deposits related to Copper, Lead & Zinc, Tin, Niobium-Tantalum, and Aluminium. |
| CO4 | The student is introduced to the detailed study, identification, recognition, uses and applications of the ore deposits related to Uranium, Thorium, Mercury, Nuclear minerals, and REE. |
| CO5 | The student is introduced to the detailed study, identification, recognition, uses and applications of the mineral deposits related to abrasive, ceramic, glass, paint and pigments, fertilizers, and cement. Outline of building and dimension stones. |

Paper II: Igneous Metamorphic petrology

| | |
|------|--|
| CO1. | The student is introduced to a detailed discussion on magma properties; generation of magma; tectonic environments of melting in the lithosphere; application of phase rule in igneous petrology and petrological significance of important synthetic magma systems; along with a short account of mantle plumes, magma plumbing, and large igneous provinces. |
| CO2 | The student is introduced to a detailed discussion on the classification of igneous rocks; magmatic differentiation; magma mixing and mingling; magma assimilation; detailed petrology and petrogenesis of: basalts; ophiolites; alkaline rocks; and ultramafic rocks. |
| CO3 | The student is introduced to a detailed discussion on Bowen's Reaction Series and its petrological significance; variation diagrams in igneous petrology; use of trace and REE in petrogenesis; detailed petrology and petrogenesis of anorthosites; lamprophyre; granite; pegmatite; carbonatite; kimberlite. |
| CO4 | The student is introduced to a detailed discussion on the classification schemes of metamorphic rocks; crystalloblastic series and interpretation of metamorphic rock textures; metamorphic reactions; regional metamorphic gradients and their types; protoliths that undergo metamorphism; Barrovian and Buchan metamorphic zones; isograds; burial metamorphic zones; metamorphic geothermometers and geobarometers. detailed petrology and petrogenesis of eclogites; migmatites; amphibolite. |
| CO5 | The student is introduced to a detailed discussion on distribution of metamorphic rocks with plate tectonic environments; paired metamorphic belts; phase rule in metamorphic systems; metamorphic facies; ACF, AKF, and AKFM diagrams; petrogenetic grids; P-T-t paths; detailed petrology and petrogenesis of granulites; charnockite; khondalites; gndites. |

Kapila

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Jaipur



ST. WILFRED'S P.G. COLLEGE

(Affiliated to the University of Rajasthan)

M.Sc. FINAL (GEOLOGY)

Paper III: Remote sensing and Exploration Geology

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| CO1. | The student is able to understand the basic elements of RS. He/she is introduced to different energy sources and their interaction with the atmosphere, spectral signatures, and atmospheric windows. |
| CO2 | The student is introduced to the types and classes of satellite RS and aerial RS. |
| CO3 | The student is introduced to AP interpretation elements and their mosaics. He/she learns and understands the elements of satellite RS. |
| CO4 | The student is introduced to thermal RS and SLAR. A short account of IRS satellites and Indian space missions is introduced. |
| CO5 | A short account of the remote sensing techniques in the study of geomorphic features and geological structures relevant to ground water and mineral exploration is emphasized. |

Paper IV: Elements of Engineering Geology, Mining Geology and ORE Dressing

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| CO1. | The student is able to understand and describe how overburden materials are removed to expose the economic deposit. Sampling of economic minerals for tenor or grade estimation in a working mine is discussed. |
| CO2 | The student is able to understand and describe the role of drilling in day to day mining operations and logging of bore hole samples done in the lease area for later mining. Open cast mining methods and the equipment used in a working mine are explained and assessed. |
| CO3 | The student is able to understand, describe, and assess the mining applied to coal seams, hard rocks, alluvial deposits, hydraulic mining, and dredging of economic minerals. |
| CO4 | The student is able to understand, describe, and assess the underground mining methods applied to coal seams and hard rocks. |
| CO5 | The student is able to understand, describe, and assess the subsurface coal mining methods, mine ventilation, groundwater problems, and modes of transportation of broken ore in mines, life cycle of a mine and reclamation of mined or quarried land after mining has effectively ceased. |

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