Shri Shivaji Science College, Amravati

Pre-stated Course Outcomes

Contents

Course Outcomes (COs)

The Course Outcomes (COs) Stated by the Departments

Biotechnology Department

Course Code	Name of the Course	COs	After completing this course students must be able to
BS1BIT1	B.Sc. SEM I Biotechnology	CO1	To understand basic unit of the organism. To understand evolution of cell
		CO2	To have knowledge on biomolecules like lipids and carbohydrates and its importance To understand structure and functions of biomolecules like nucleic acid and proteins
		CO3	To know components of the cell and their interaction To describe ultrastructure and functions of various cell organelles
		CO4	To explain cell transportation &To understand Cell Fractionation
		CO5	To understand Cytoskeleton, cell - cell interaction- To know about cell division and cancer.
		CO6	To perform practical like test for carbohydrates, protein and fats. To determine Qualitative analysis sugar in urine and blood To estimate Proteins by experiemtal methods.
		CO7	To determine quantitative analysis of DNA and RNA To demonstrate osmosis and diffusion.
		C08	To perform Chromatography. To demonstrate Cell lysis methods, density gradient and differential centrifugation.

Course Code	Name of the Course	COs	**After completing this course students must be able to**
BS2BIT1	B.Sc. SEM II Biotechnology	CO1	To know basic techniques in Microbiology To understand basic microbial structure and function..
		CO2	To know microscopy and different types of microscopes. To understand various staining techniques.
		CO3	To study the characteristics of microbial cell structure. To know classification of bacteria according to Bergey'smanual. To understand microbial metabolism.
		CO4	To study Nitrogen fixing microorganisms in agriculture. To explain industrially useful organism.
		CO5	To explain Elementary knowledge of diseases caused by bacteria and viruses. To study structure and pathogenicity of mycoplasma. To understand host defense mechanisms against microorganisms.
		CO6	To perform isolation of microbes from different environments Enumerate microbes by standard plate count. Identified isolated microbes by using various staining techniques.

	CO7	To perform biochemical characterization of microorganisms. To demonstrate antibiotic sensitivity testing.
	C08	To perform one step growth of virus (bacteriophage). To isolate organisms from leaf and root nodule.

Course Code	Name of the Course	COs	After completing this course students must be able to
BS3BIT1	B.Sc. SEM III Biotechnology	CO1	To understand essential mathematics. To understand limits of a function also derivatives and integration.
		CO2	To know basics of statistics, Sampling and its types . To study Probability . To describe measures of central tendencies, mean, mode and median.
		CO3	To explain acids and bases, pH and pOH, Ionization of acid. To understand buffer capacity, HH equation and blood buffers.
		CO4	To know basics and role of radioactivity in Biotechnology. To understand thermodynamics as applied to biological systems.
		CO5	To understand historical overview of Bioinformatics. To know about primary, secondary and composite database
		CO6	To perform validation of Beer-Lambert's law. Determination of absorption maxima of DNA, protein and chlorophyll.
		CO7	Determination of least count for ocular micrometer and to determine size of microscopic cells using ocular micrometer.
		CO8	To retrieve data from NCB, EBI and PDB.
		C09	To perform practical based on Chi square test and t-test.

Course Code	Name of the Course	COs	After completing this course students must be able to
BS4BIT1	B.Sc. SEM IV Biotechnology	CO1	To understand molecular basis of life. To understand Structure of DNA and its replication, DNA damage and repair mechanism.
		CO2	To explain genome organization in higher organism. To know Transcription, translation, RNA. To understand the steps involved in recombinant DNA technology.
		CO3	To explain the construction of DNA and c DNA library and their applications. To understand application of Biotechnology in medicine.

	CO4	To explain fermentation, its types and types of fermenter. To understand production of various industrially important products like alcohol, penicillin, amylase, citric acid
	CO5	To understand application of biotechnology in environment To explain various methods like bioremediation, bioleaching, degradation of xenobiotic compounds . To understand water treatment plant.
	CO6	To perform Agarose gel electrophoresis. To isolate genomic DNA and plasmid DNA.
	CO7	To perform DNA ligation and transformation. To perform restriction digestion of plasmid
	CO8	To do laboratory production of alcohol, amylase and citric acid.
	CO9	Isolate nitrogen fixing bacteria azotobacter. To isolate phosphate solubilizing bacteria.
	C10	Determination of COD and BOD of various water samples.

Course Code	**Name of the Course**	**COs**	**After completing this course students must be able to**
BS5BIT1	B.Sc. SEM V Biotechnology	CO1	To understand structure and organization of cells in various tissues. To explain structure of extracellular matrix.
		CO2	To explain historical development of animal cell culture. To understand design and layout of the animal cell culture laboratory.
		CO3	To know functioning of equipments used in animal biotechnology laboratory. To explain various media required for the growth animal cell culture. To understand types of animal tissue culture.
		CO4	To describe establishment and maintenance of cell line and characterization of cell lines. To understand applications of animal biotechnology in various fields.
		CO5	To describe specialized techniques like suspension culture, continuous culture, monolayer culture.

		To establish synchronous cultures and culture of amniocentesis.
	CO6	To prepare various balance salt solutions. To prepare TPVG and filter sterilization.
	CO7	To Perform separation of serum and filter sterilization. To Perform dissociation of cells from primary tissue and from culture vessels.
	C08	To estimate viability of cells by dye exclusion method. To enumerate cells using Haemocytometer.
	C09	To prepare primary culture from chick embryo. To Maintain and subculture the cell lines.

Course Code	Name of the Course	COs	After completing this course students must be able to
BS6BIT1	B.Sc. SEM VI Biotechnology	CO1	To understand basic terminologies of plant tissueculture. To know effect of environmental factors on plant growth.
		CO2	To understand use of various plant growth substances. To know Introduction and history of practical applications of tissue and organ culture.
		CO3	To understand media preparation and composition.
		CO4	To describe Clonal multiplication of elite species from axillary bud, shoot tip and meristem culture. To know hardening of tissue cultured plant.
		CO5	To understand somaclonal variation and its application. To explain single cell suspension culture and their applications.
		CO6	To understand protoplast isolation and regeneration. To understand various methods of genetic manipulations. To describe somatic hybridization and its applications.
		CO7	To perform bioassay of Indole acetic acid and gibberlic acid.
		CO8	To perform initiation and maintenance of callus culture of soybean. To study of growth parameters of callus culture. To perform initiation and growth study of suspension culture.
		C09	To perform induction shoot and root initiation by modulating hormone balance. To perform single cell suspension.
		C10	To perform generation of somatic embryo from suspension culture of carrot. To perform Induction of Agrobacterium infection in any dicot leaf and maintenance of callus.

Botany Department

Course Code	Name of the Course	COs	At the end of the course, students are expected to be able to:
BS1BOT1	B.Sc. SEM I Botany	CO1	Know Introduction of Cryptogams and general account of viruses.
		CO2	To know Classification and general characters of algae.
		CO3	Explain the Classification and general characters of Fungi.
		CO4	Classify and know general characters of Bryophytes.
		CO5	Classify and know general characters of Pteridophytes. .
		CO6	Understand economic importance of microbes and cryptogams.
		CO7	Know the systematics, morphology and structure of algae, fungi , bryophytes, and Pteredophytes.
		CO8	Know life cycle pattern of cryptogams.

Course Code	Name of the Course	COs	At the end of this course, students are expected to be able to:
BS2BOT1	B.Sc. SEM IIBotany	CO1	Explain Geological time scale and fossil gymnosperms.
		CO2	Understand Brief Classification and general accounts of Gymnosperms.
		CO3	Understand Morphology of food, oil,fibre crop plants. Uses of plants Parts.
		CO4	Focus on deep study of Pharmacognosy and phytochemictry of medicinal plants.
		CO5	Know, scope and application of Palaeobotany.
		CO6	To understand role of living and fossil plants in our life.
		CO7	Systematic study of gymnosperms

Course Code	Name of the Course	COs	After completion of this course, students are expected to be able to:
BS3BOT1	B.Sc. SEM IIIBotany	CO1	Explain Origin and evolution of angiosperms.
		CO2	Know deep study on Systematic of Classification of Angiosperms.
		CO3	An accounton Systematic study of Dicotyledons and monocotyledons (Families).
		CO4	Brief about general characteristics and anatomy of root and stem.
		CO5	Know about Embryology
		CO6	Make herbarium and identify the plants.
		CO7	Section cutting, make Permanent slides and differentiate tissues.

Course Code	Name of the Course	COs	After completing this course, students are expected to be able to:
BS4BOT1	B.Sc. SEM IV Botany	CO1	Understand the basic concepts of Cell biology, Genetics and biochemistry.
		CO2	Explain Structure and function of cell organelles.
		CO3	Understand Mendel's Law and solve Problem of genetics.
		CO4	Explain Enzymes their activities and Understand Carbohydrates
		CO5	Analyze various biochemical tests like protein, lipid, oil, starch and cellulose.
		CO6	Understand the Significance of mitosis and meiosis

Course Code	Name of the Course	COs	At the end of this course, students are expected to be able to:
BS5BOT1	B.Sc. SEM V Botany	CO1	Brief about the Mechanism of Water translocation in plants.
		CO2	Have ideas of Metabolic activities - photosynthesis and respiration.
		CO3	Havedeep knowledge of Nitrogen metabolism and growth hormones.
		CO4	Explain Concept of Photoperiodism and plant movements.
		CO5	Structure and function of ecosystem.
		CO6	Know scope, importance of plant physiology and Understand plant & water relation.
		CO7	Observe amazing things regarding photosynthesis and respiration.
		CO8	Study of morphology and anatomy in hydrophytic and xerophytic plants.

Course Code	Name of the Course	COs	After completing this course, students are expected to be able to:
BS6BOT1	B.Sc. SEM VI Botany	CO1	Explain Structure and function of DNA.
		CO2	Understand Transcription and Translation in Eukaryotes.
		CO3	Gene regulation in Prokaryotes.
		CO4	Do Techniques of gene transfer.
		CO5	Clear ideas of Plant tissue culture and understand Role of Biotechnology in Agriculture, Industry and Health care
		CO6	Have experiential learning in advanced subjects of Molecular Biology and Plant Biotechnology
		CO7	Joyful experience of observing most precious biomolecules like DNA, RNA and proteins and their Qualitative and Quantitative estimations

	CO8	Demonstrate of advanced tools like electrophoresis, centrifuge, laminar air flow chambers, autoclaves, etc. will offer understanding of those sophisticated techniques
	CO9	Do Viability test, germination process, isolations of cell protoplasts, preparation of artificial seeds confers hands on proficiency
	CO10	visits of research institutions and laboratories envisioned expansion of the vision to the current and future line of research

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–I –Botany students must be able to
	M.Sc. SEM I - Botany	CO1	Knowledge about cell organelles, cell cycle, Chromosomes, Regulation of geneexpression, Mutation, cancer and Genetics of Nitrogen fixation
		CO2	Explain Karyotype Analysis , Isolate of any cell organelle , perform Smear/Squash Technique/ Specialized Chromosome and solve Problem on interaction of genes
		CO3	Explain Concept of Biodiversity, Understand Green revolution, Sanctuaries, National parks, Biosphere reserves. Explain Ex- situ conservation, and General accounts and activities of national institutes.
		CO4	Identification and morphological description with economic important of plantChemical Characterization of tannins, resins, dyes, fibres.
		CO5	Isolate and identify algal forms .Brief Classification, reproduction and Economic importance of Algae. Knowledge of Bryophytes. Skill of Microtomy
		CO6	Explain features of plant development, Organisations of SAM Knowledge of plant reproduction.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–II–Botany students must be able to
	M.Sc. SEM II - Botany	CO1	Explain polyploidy and Plant Breeding,Physical mapping of genes on chromosomes. Explain Gene expression and its regulation in Eukaryotes.Use of Molecular markers. To know about Molecular Biology and Bioinformatics
		CO2	Achieve skill in Isolation and Estimation of DNA by UV-VIS spectrophotometry. Perform Biostatistical analysis of given data
		CO3	Explain important bacterial, viral diseases of regional crops. Understand Fungi as Biological Agent. Identify and classify Fungal cultures and plant disease material with its diagnostic characters.
		CO4	Brief account of Photosynthesis, Respiration, Growth Regulators and Elicitors
		CO5	Perform major and minor physiology and plant metabolism experiments. Explain Principles and working of instruments. Perform Phytochemical tests.

		CO6	Explain Carbohydrate, Amino Acid , Lipid, Nitrogen and PhosphateMetabolism

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–III–Botany students must be able to
	M.Sc. SEM III - Botany	CO1	Outline Classification and knowledge of anatomy and reproduction Pteridophyta.
		CO2	Explain Classification of gymnosperms along with Morphology, anatomy, reproduction and evolution in gymnosperms Make double stained permanent micropreparation
		CO3	Explain Systems of Angiosperm classification, Taxonomic hierarchy DiffertantiateEcads& Ecotypes
		CO4	Explain Systematic studies of Dicot and Monocot families. Write Systematic description of angiospermicplant species. And Identify Fossil Specimens.
		CO5	Explain Mycorrhizae ,Human diseases caused by dermatophyte Describe Industrial production of Penicillin, Enzymes and Fungi in medicine
		CO6	Understand Koch's Postulate - Principles and method Demonstrate Koch's postulate and pure culture technique. Identify and describe fungal plant diseases. Identify and give salient features of fungi from the mix culture.
		CO7	Understand Integrated Pest management (IPM),Diseases of cereals Know General account of postharvest diseases of vegetables and fruits Clear ideas of Viral diseases
		CO8	Identify, classify and describe fungi from given seed borne mycoflora, soil mycoflora, Rhizospheremycoflora.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–IV–Botany students must be able to
	M.Sc. SEM IV - Botany	CO1	Understand effects of Ecological factors, Community concept, Types and mechanism of ecological succession Differentiate between Abiotic and biotic components Gain knowledge of Major Biomes of the world.
		CO2	Understand EIA, Effect of solid waste disposal on soil, Consequences of water pollution Know Disaster management,Impact of urbanization
		CO3	To measure rainfall. Transparency of water. To evaluate the soil texture and estimation of pH of water and soil
		CO4	Knowledge of Plant Cell and tissue culture, Clonal propagation, GMOs,Phytoremediation. Importance and application of microbes in Biotechnology
		CO5	Skill for Bacterial cultures and maintenance of Cell lines. Know Aims and strategies for transgenic development. Brief aboutaccount of Alien gene transfer Understand Gene Knockout Technologies.
		CO6	Preparation of stock solution and culture media. Isolation and estimation of Bacterial genomic DNA

		CO7	Understand the various aspects of Botany by working on different problems given by their supervisor. Use various techniques that they do in their projects. Observe the scientific things very closely. Apply their knowledge practically. Write the dissertations and research paper
Course code	**Name of the course**	**COs**	**After completing the course, "M.Sc. Sem–I –Bioinformatics students must be able to**
	M.Sc. SEM I - Bioinformatics	CO1	Mathematical calculations and concept of Calculus and Integration.Basic concepts and methods of Biostatistics.
		CO2	Introduction to prokaryotic and eukaryotic cells, cell organelles Introduction to molecular biology and process
		CO3	Introduction to Computer , MS-Office ,Internet and Networking C programming
		CO4	Introduction to Bioinformatics, History, Scope and Applications Biological Data Acquisition,Databases: Format and Annotation Data: Access, Retrieval and Submission, Sequence Similarity Searches
		CO5	Identification and Study of morphology of Bacteria, Fungi and Yeast Estimation of biological molecules Isolation & Purification of genomic contents Bio-molecule separation techniques
		CO6	Execution of different commands and file operations Overview of different versions of Windows, handling of Basic Programs, Files & Folders, Windows Properties, documents, formatting and presentation Working with C Programming
		CO7	Introductions to different Biological Databases , biological file formats and Literature databases Introductions to different Biological software's and tools

Course code	**Name of the course**	**COs**	**After completing the course, "M.Sc. Sem–II–Bioinformatics students must be able to**
	M.Sc. SEM II - Bioinformatics	CO1	Biochemistry of water, Carbohydrates and lipids.Nucleic acids and proteinsTranscription and Translation mechanism of Prokaryotic and eukaryotic organism.
		CO2	Overview of various equilibrium phenomena, Electrochemical Techniques and Centrifugation principles. Overview of different Spectroscopy methods and principles.
		CO3	Introduction to genomics with their scope and application. Functional Genomics methods, Microarray and Human Genome Project. Introduction to genome analysis and different tools Concepts of Comparative Genomics and Phylogenetic analysis
		CO4	Introduction to BDBMS and Concepts of DBMS Architecture, Data models in DBMS, Structured Query Language Relational Database and Storage, Introduction to MySQL
		CO5	Introduction and overview of different biological databases, Advanced techniques in bioinformatics. Signal in DNA sequence and analysis methods

		Genome Rearrangement, DNA microarray and technologies
	CO6	Experiments on Physiology, Mol. Biology Handling of biological software's, Phylogenetic analysis

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–III–Bioinformatics students must be able to
	M.Sc. SEM III - Bioinformatics	CO1	Introduction to System Biology,Biochemical Reaction Kinetics and simulation Reconstruction of Biochemical Networks Introduction to Synthetic Biology, R programming
		CO2	Introduction to Proteomics, Comparative Proteomics and Advance Proteomics
		CO3	Introduction to PERL, Bio-PERL, ODBC, HTML and CGI
		CO4	Introduction to Parasitic Diseases, Host-parasite interaction Approaches to novel drug discovery for parasite
		CO5	System Biology software's and tools, Microbial Database, MLVA, HBMMD, DSMZ, RIDOM and GPMS Protein Sequence and Protein Structure Databases Advanced Visualization Software and 3D representations
		CO6	Pearl programming File handling programmes Pearl programming using loops programmes, condition statements programmes, subroutine programmes Regular Expressions programmes

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–IV–Bioinformatics students must be able to
	M.Sc. SEM IV - Bioinformatics	CO1	Concepts in Molecular Modeling Introduction to Molecular Mechanics,Molecular Dynamics Simulation Methods, Molecular Modeling in Drug Discovery Structure Activity Relationship
		CO2	Introduction to Chemo-informatics, quantum methods and combinatorial chemistry,Drug Designing, QSAR Target Identification: Molecular Modelling and Structure Elucidation and tools,Drug Discovery and Pharmacophore analysis
		CO3	Introduction to Java language Concept of Inheritance and Packages and Interfaces, Multithreaded programming Introduction to Java Applets, Bio-Java
		CO4	Overview of Research Methodology. General principles of Intellectual property rights. Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright.
		CO5	Bioethics and Bio safety regulation,Environmental aspects of biotechnology applications.
		CO6	Binding site and Pharmacophore identification. Rigid body docking using Autodock and ADT. Visual Molecular Dynamics (VMD)

		Docking with LigandFit (Discovery Studio) Receptor and Ligand Optimization
	CO7	The projects based on Biological database designing, software designing tool designing,Chemo-informatics, Comparative genomics and proteomics Drug designing, Molecular modelling, Parasite bioinformatics, Pharmaco-informatics, Plant bioinformatics, Structural biology,Systembiology,Vaccine designing

Chemistry Department

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–IV– Bioinformatics students must be able to
	B.Sc. Sem.I Chemistry	CO1	Learn the basic concepts ofperiodic properties of elements; understand formation of different types of bonding & factors affecting ionic bond formation.
		CO2	Understand properties viz, electronic configuration, ionization energy, and oxidation state of s and p block elements.
		CO3	To learn about the various effects operating through the covalent bonds, to understand the physical and chemical properties of aliphatic hydrocarbon.
		CO4	Have aknowledge of the aromaticity, structural and chemical behavior of aromatic hydrocarbons and their applications on the basis of electrophilic substitution.
		CO5	Learn fundamentals of Thermodynamics, Thermodynamic properties, laws of Thermodynamicsand know the concept of entropy.
		CO6	Understand the ideal& real gases concept through state variables & mathematical equationsand application of phase rule on water system and sulphur system.
		CO7	Develop skills required for the synthesis of one step organic compoundsbasedon Green Chemistry
		CO8	To analyzed the radicals (acidic, basic and neutral) from given mixture required for industry.
			SEMESTER - II
	B.Sc. Sem.II Chemistry	CO1	Define polarization and its application, directional nature of covalent bond, concepts of hybridization and know the theory of acids and bases.
		CO2	Understand requirement of good solvent and classification of solvents.
		CO3	Basic understanding about the classification, preparation and chemical reactions of Phenol, Ethers and Epoxides. Describe synthesis and chemical reactions of alkyl halides, aryl halides and alcohol
		CO4	Understanding the preparation of hydroxyl and halogen derivatives of aliphatic and aromatic hydrocarbon and

		the reactions mechanisms involved in their synthesis and chemical reactions.
	CO5	Accruing the information about the study of magnetic properties of substances.Identify polar and non-polar molecules and know paramagnetic and diamagnetic substances.
	CO6	Students learnt about rate of reaction, order of reaction, molecularity of reaction along with energy changes. Describe rate of reaction in terms of change in concentration and how the rate of chemical reaction changes as a function of time.
	CO7	Aims toenable the students, to identify the given organic compound containing different functional groups through its detail qualitative analysis and to prepare its solid derivatives.
	CO8	Students gain an understanding of Determination of activation energy, heat of solution. Experimental techniques to study various properties of liquid state such as surface tension, viscosity, Parachor are implemented
	SEMESTER - III	
B.Sc. Sem.III Chemistry	CO1	To explain the concept of bonding through MOT and VBT&predicts the geometry of the Covalent molecules.
	CO2	Impart a broad outline of the methodology and working in the metallurgical process.
	CO3	To understand the chemistry of Aldehyde and Ketones and also study of different Organic Acids and their acidic strengths.
	CO4	How to use their understanding of stereochemistry of different compounds and predict the outcome of reactions.
	CO5	To learnt the thermodynamical concept &important role in extraction and separation techniques used in the industrial applications.
	CO6	To understand basic partof electrochemistry and most important properties of liquid state which is useful to study the physicochemical properties of liquids.
	CO7	To analyse the process for the identification of organic compounds and would get expertise in Volumetric and Gravimetric Analysis.
	CO8	To understand different concepts of physical chemistry through experiments. Develop skills required for the determination of surface tension, viscosity and effects of temperature
	SEMESTER - IV	
B.Sc. Sem.IV Chemistry	CO1	To understand the physical and chemical properties of transition element and know about extraction of elements.
	CO2	Study the concept of inner transition elements and know their properties and general principle of metallurgy.

	CO3	Exposure to the ORGANIC chemistry of Polynuclear Hydrocarbons, Reactive Methylene Compounds and know about carbohydrates.
	CO4	To understand and study of Derivatives of Benzene, Amino acids and their properties.
	CO5	To gain the information about all the colligative properties of dilute solution and know to determination of molecular weight of solute.
	CO6	Impart an idea about applications of solid state and Nanotechnology research field.
	CO7	To study the effect of various indicators in Inorganic estimations and different types of titrations.
	CO8	Develop skills required for the quantitate analysis of organic compounds
	SEMESTER - V	
B.Sc. Sem.V Chemistry	CO1	Impartbasic ideas to categorize the coordination compounds on the basis of various theories and on the basis of electronic structure and magnetic properties.
	CO2	To understand colour of coordination compounds and colour of coordination compounds on the basis of CFT and their applications in qualitative analysis.
	CO3	Design the synthesis of heterocyclic compound and organometallic compounds which is required for era of medical research.
	CO4	Know method of synthesis & their application of Dyes, Drugs and Pesticides in industry purpose.
	CO5	Gain information about photochemistry which is very useful in the research field of photochemical reactions.
	CO6	To study the basic information about molecular spectroscopy, useful tool for the structure determination of newly synthesized compound in research.
	CO7	This course enables the students to acquire knowledge on the principal laboratory methodologies for the synthesis and characterisation of coordination compounds.
	CO8	Conductometric and potentiometric titrations are very useful for the analysis of various compounds including pharmaceutical, inorganic, organic, etc compounds. The colligative properties are used to study molar mass, depression in freezing point and elevation in boiling point
	SEMESTER - VI	
B.Sc. Sem.VI Chemistry	CO1	Explain the kinetic aspects of metal complexes and techniques in analytical chemistry such as spectrophotometry, colorimetry and paper chromatography.
	CO2	This course deals with organometallic chemistry, inorganic polymer and bioinorganic chemistry which help students to understand the role of coordination compounds in polymer chemistry and biological process.

	CO3	To know the information of electronic transition on the basis of UV-Vis Spectroscopy and identify various functional groups and structure elucidation of organic compound by IR spectroscopy.
	CO4	How to determine the structure of organic molecules using Nuclear Magnetic Resonance spectroscopy and mass spectrometry which is useful in research and various industries.
	CO5	Quantum mechanics is very important branch of physical chemistry. Students utilized their knowledge to study the shapes of orbital and to find out probability and probability density.
	CO6	This part of the syllabus gives the information about electrochemistry and Nuclear chemistry. This knowledge is used in Pharmaceutical and nuclear industries to analyzed and synthesized compound as a alternate source of energy
	CO7	To quantitatively separate organic compounds (Glycine, Phenol, Aniline, Urea from unknown sample) and to separate and identify the organic compounds using chromatographic techniques
	CO8	Explain the principle behind the physical chemistry experiments performed in the laboratory and Interpret experimental results.

Course code	**Name of the course**	**COs**	**After completing the course, "M.Sc. Sem–III–Bioinformatics students must be able to**
	M.Sc. Sem I Chemistry Paper I	CO1	Learn stereochemistry of and bonding in main group elements like PCl_5 and molecular orbital representation of some polyatomic molecules with special reference to CH_4.
		CO2	Tounderstandmetalligand bondingwiththerecapulationof CFT and from the next part they have learned about molecular orbital representation of some co-ordination compounds.
		CO3	Study the classification, nomenclature, structure and bonding in boranes and the topology of boranes and again learned about the formation of metal clusters and the formation of macrocyclic complexes.
		CO4	Know about what is non-aqueous solvent and how to use inorganic solutes in organic solvents with solvent system concept. From the next part they have understood the concept of metal-ligand equilibria in solution.
		CO5	Concept like symmetry of elements, determination of point group and to draw group multiplication tables of various compounds,Milliken symbolism of irreducible representation etc.
		CO1	Think about nature and bonding in organic compounds, delocalization of bonds and conjugation in it. They are

M.Sc. Sem I Chemistry Paper II		also able to learn about aromaticity in benzenoid and non-benzenoid compounds, steric effect etc.
	CO2	Handle the molecule in 3D space for understanding stereochemistry of molecules, interconversion of configuration and dealing with reaction with respect to stereochemistry.
	CO3	Reaction mechanism, thermodynamic and kinetic aspects and different conditions required for completion of reaction and equation like Hammet equation and Taft equation have been able to tally.
	CO4	To work with some Aliphatic Nucleophilic substitution, nucleophile, selectivity and the examples related with it. Understand about elimination reactions and the conversation from one group to another.
	CO5	What are Aromatic electrophilic substitution and formation of electrophiles, attack on aromatic ring and delocalization, stability. On the other hand also able to work on aromatic nucleophilic substitution and the difference between them.
	CO6	Handle laboratory equipment, chemicals and using different practical apparatus. To do practically some reactions like Aldol condensation, Diel's-Alder reaction etc. Instruments can handle with precautions.
M.Sc. Sem I Chemistry Paper III	CO1	UnderstandSchrodinger equationin one and three dimensional box, pertumbation theory, rigid rotor, and the application in Quantum Chemistry. Think about ordinary and generalized angular momentum, eigen concept and can solve numericals based on that concept.
	CO2	Action on the surfaces of different liquids like adsorption, Freundlich, Langmuir,Gibb's adsorption isotherm and the micelles chemistry is understandable to them.
	CO3	Deal with thermodynamics containing classical and non-classical thermodynamics, phenomenological equations and the numericals based on this concept.
	CO4	Understand Nuclear reactions and different phenomenon related with it like nuclear decay, fission, fusion, different particles formed or generated in the reaction. Concepts of reactor and the half life reactions etc.
	CO5	Learn about Chemical dynamics which contains collision and transition state theory,application of TST to reaction between atoms and molecules. Know about unimolecularreaction and reactions in solvent.
	CO6	Work with apparatus, Chemical handling, preparation of solution, concept of Concentration and working non-instrumental and instrumental practicals.

			Stalagmometer, conductometer instruments like these can be operated safely.
	M.Sc. Sem I Chemistry Paper IV	CO1	Study the Basic concepts of Analytical Chemistry, Role of Analytical Chemistry, The nature of analytical chemistry, the role of analytical chemistry, qualitative and quantitative analytical methods, Classification of analytical methods-classical & instrumental. Types of instrumental analysis. Selecting an analytical method.
		CO2	Collection, Treatment and presentation of analytical data. True, standard and observed value. Defination of terms in mean and median. Errors in chemical analysis, classification of errors, nature and origin of errors. Accuracy and precession, errors in quantitative analysis and their minimization.
		CO3	Study of Advanced level treatment of solvent Extraction: Introduction, Liquid-liquid extraction-continuous and counter current extractions, synergic extraction, ion-pair or ion association extraction, Extraction by equilibrium shifts. Also know about ion exchange separation and its application in analytical Chemistry.
		CO4	Theory and Instrumentation of GC, Applications of GLC,Use of GC-MS. High Performance Liquid Chromatography (HPLC) contains Theory and instrumentation of HPLC, Optimization of column performance, Gradient elution and related procedures, Derivatization, Mobile phase delivery system, sample injection, separation column, detectors, Interfacing HPLC ,GC-MS and LC-MS, Applications and Problems.
		CO5	Safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals. Explosives &Chemical weapons, Chemical explosives: Origin of explosive properties in organic compounds, classification of that is understandable to students.
	M.Sc. Sem II Chemistry Paper V	CO1	Introduction of electronic spectra of transition metal complexes. Derivation of term symbols for ground and excited states of dn configurations, (L-S coupling and j-j coupling), microstates, Types of experimental recording of the spectra, Selection rules and the concept of magnetochemistry is understandable.
		CO2	Study the Reaction Mechanism of Transition Metal complexes-I , Classification of Inorganic reactions, Energy profile diagram with terminology includes transition state or activated complex, substrate, attacking reagents electrophilic and nucleophilic. Reactivity of metal complexes, ligand replacement reaction, classification of mechanism and energy profile of reaction.

		CO3	Reaction Mechanism of Transition Metal complexes-II, Substitution reaction in square planer complexes, the trans effect, trans-directing series, cis effect, steric effect, solvent effect, effect of leaving group, effect of charge, effect of nucleophile, effect of temperature. Trans effect theories, uses of trans-effect, mechanism of substitution reactions in Pt(II) complexes. Electron transfer reactions.
		CO4	Learn about Metal pi-Complexes containing Metal carbonyls, Structure and bonding, structural elucidation of metal carbonyls (by IR, and 13C NMR spectra), Metal carbonyl clusters with reference to classification, EAN rule, synthesis and structures. Application of Wilkinson's catalyst and Vaska's compound.Metal nitrosyls, Nitrosylating agents and its chemistry , Fluxional Organometallic compounds.
		CO5	Concept of Overview of Bioinorganic chemistry, biological role of alkali metal ions, ligands, ion transport across the membrane, Classification as enzymatic and non-enzymatic metals. Bioinorganic chemistry of Fe: Hemoglobin and myoglobin, their structures and functions, Bioinorganic chemistry of Co:Vitamin-B12, its structure and biochemical function and mechanisms of action.
		CO6	Prepare inorganic compounds by greener methods and their characterization by elemental analysis, MW determination, decomposition temperatures and molar conductance studies. Quantitative analysis of mixtures of two cations and radicals.
	M.Sc. Sem II Chemistry Paper VI	CO1	Addition to C-C & C-X multiple bond, Mechanistic and stereo chemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, Orientation and stereochemistry. Classification and General mechanistic treatment of electrophilic, nucleophilic and free radical molecule rearrangement.
		CO2	Radical anions and radical cations, Types of free radical reactions, free radical substitution mechanism at an aromatic substrate, aliphatic substrate, reactivity at a bridgehead position. Neighbouring group assistance, reactivity for aliphatic and aromatic substrates, effect of solvent on reactivity at allylic carbon, hydroxylation at an aromatic carbon by means of Fenton's reagent.
		CO3	From Photochemistry- Interaction of radiation with matter, types of excitation, quenching, Quantum efficiency, quantum yield, transfer of excitation energy, actinometry, Photoinduced energy transfer, FRET, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions Paterno –Buchi reaction, Photoreduction, Photochemistry of enones can study easily.

	CO4	Understand about new type of Pericyclic Reactions, Molecular orbital symmetry, Frontier orbitals of ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, allyl system, classification of pericyclic reaction . FMO approach, Woodward-Hoffman correlation diagram method and Peturbation of molecular orbital (PMO) approach of pericyclic reaction under photochemical conditions
	CO5	Design a green synthesis: Choice of starting material, choice of solvents. Basic principle of green chemistry: Prevention of waste by products, Maximum incorporation of the reactants (starting material and reagents) into the final products. Rearrangements reaction, Addition reaction, substitution, elimination reaction, Prevention or minimization of hazardous products. Designing of safer chemical.
M.Sc. Sem IIChemistry Paper VII	CO1	Catch about A) Kinetics of Complex reactions: Chain reaction (H2+Br, ® 2 HBr thermal and photo chemical reaction), Homogeneous catalysis (acid-base and enzymes), oscillating reactions. B) Fast reactions: General features of fast reactions, Stopped flow method, relaxation method, Nuclear magnetic resonance method, Flash Photolysis, Numericals.
	CO2	Understand the Construction of M.O.by LCAO for H2+ ion, Calculation of energy levels from wave functions, physical picture of bonding & anti-bonding wave functions, concept of orbitals. Hybride orbitals sp, sp2, sp3; Calculationof coefficient of A.O. used in hybride orbital; Huckel theory of Conjugated systems, bond order & charge density calculations. Applications to ethylene, butadiene, and concept based Numericals
	CO3	Tell about Macromolecules, types of polymers, Random coils, configuration and conformation of macromolecules, electrically conducting molecular wires, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. stability of biological polymers, Application of polymers.
	CO4	Electrochemistry of solutions: Debye-Huckel-Onsager treatment and its extension. Bio-electrochemistry, threshold membrane phenomenon, Nernst -Plank Equation, Hodges Huxley equation, core conductor models, electrocardiography. The rate of charge transfer, the Butler-Volmer equation, the low overpotential limit the high overpotential limit, Tafel plot. And problems based on this concept can be solved.
	CO5	Deal with Statistical Thermodynamics, Thermodynamic probability, most probable distribution. Maxwell-Boltzmann distribution law

			Fermi-Dirac statistics, distribution law and applications to metals. Bose-Einstein statistics - distribution law and application to helium. Partition function, calculations of thermodynamic properties in terms of partition functions. Applications and Numericals.
		CO6	Do practical's from physical chemistry by handling viscometer, to determine solubility and in part B they can handle pH meter, refrectometer, polarimeter for different instrumental practicals.
	M.Sc. Sem II Chemistry Paper VIII	CO1	Understand about Optical Methods containing spectrophotometry and colometry and application of quantitative and qualitative analysis and problems based on it. Theory, instrumentation and applications of fluorimetry, Nephelometry, turbidimetry, Polarimetry &Refractometry.
		CO2	Know about what is Flame Emission and atomic spectrometry, Elementary theory of flame photometry. Instrumentation and experimental techniques. Interferences, analytical techniques and applications. Introduction, principles of AAS.
		CO3	Origin of wastewater, types, water pollutants and their effects. Sources of water pollution, domestic, industrial, agricultural soil and radioactive wastes as sources of pollution, and also known about the objectives of waste water analysis.
		CO4	learn what are sources and sinks of gases pollutants, classification of air pollutants, effect of air pollutants on living and non-living things. Sources of air pollution, air quality standards and sampling. Analysis of air pollutants, Green house effect, acid rain, ozone depletion and their consequences on environment. Effects of air pollution, photochemical smog and monitoring of air pollution.
		CO5	Tallythe Chemistry of soil, soil irrigation by effluents. Agricultural pollution, role of micronutrients in soil, trace element analysis in soilPesticides and pollution. Also able to study the effect of radiation on soil.

Computer Science Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM I Computer Sci	CO1	Students should Understands the basic concepts of computers.
		CO2	Students should able to elaborate topic of Computer science.
		CO3	Learn basic programming techniques.
		CO4	Should able to do logical designing such as algorithm.
		CO5	Able to access C programming tools.
		CO6	Able to do implementation by using C programming tools.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM II Computer Sci	CO1	Understand basic tags used in HTML and XML.
		CO2	Apply mark-up tags for processing and presentation of information on web pages.
		CO3	Should design web pages for different contents.
		CO4	Use scripting languages to add interactive components to web pages.
		CO5	Students will be able to write a well formed or valid XML document.
		CO6	Able to do implementation by using advanced C programming techniques.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM III Computer Sci	CO1	Should be able to analyse various algorithms.
		CO2	Understand searching and sorting techniques.
		CO3	Should understand stack, queue and linked list operation.
		CO4	Should get knowledge of tree and graphs concepts.
		CO5	Know the concepts of object-oriented programming.
		CO6	Able to do implementation by using C++ programming tools.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM IV Computer Sci	CO1	Understanding of the Elementary & Advanced Features of DBMS & RDBMS.
		CO2	Good Practical Understanding of the SQL.
		CO3	Prepare Various Database Tables using SQL Commands.
		CO4	Able to Develop Structured Query Language (SQL) Queries to Create, Read, Update, And Delete Relational Database Data.

		CO5	Should write PL/SQL program.
Course Code	**Name of the Course**	**COs**	**After completing this course students must be able to**
	B.Sc. SEM V Computer Sci	CO1	Understand the code solution and compile VB project in .NET framework.
		CO2	Design and develop console and windows base .NET applications.
		CO3	Learn about MS.NET framework developed by Microsoft.
		CO4	To develop, implement, and demonstrate Component Services, and Windows and web services.
		CO5	Able to get familiar with Java programming and to learn classes and objects.
		CO6	To learn programming using Java.
		CO7	Able to use Java Applets

Course Code	**Name of the Course**	**COs**	**After completing this course students must be able to**
	B.Sc. SEM VI Computer Sci	CO1	To learn and understand advance concept of Java.
		CO2	Able to write program using Exception Handling.
		CO3	To learn the programming using Servlets and JSP.
		CO4	To learn Java Bean so as to make the reusable software components
		CO5	Be able to understand use of VB.NET basics, Objects and Types.
		CO6	Be able to understand ADO.NET. Understand developing, implementing and creating Applications in VB.NET and database.

Course Code	**Name of the Course**	**COs**	**After completing this course students must be able to**
	B.Sc. SEM I Computer Application (Voc.)	CO1	Understands the basic concepts computers.
		CO2	Students should able to elaborate topic.
		CO3	Learn basic programming techniques.
		CO4	Should able to do logical designing such as algorithm.
		CO5	Able to access C programming tools.
		CO6	Able to do implementation by using C programming tools.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM II Computer Application (Voc.)	CO1	Understand basic tags.
		CO2	Apply markup tags for processing and presentation of information on web pages.
		CO3	Should design web pages.
		CO4	Use scripting languages to add interactive components to web pages.
		CO5	Students will be able to write a well formed or valid XML document.
		CO6	Able to do implementation by using advanced C programming techniques.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM III Computer Application (Voc.)	CO1	Should be able to analyse algorithms.
		CO2	Understand searching and sorting techniques.
		CO3	Should understand stack, queue and linked list operation. tools.
		CO4	Should get knowledge of tree and graphs concepts.
		CO5	Know the concepts of object-oriented programming.
		CO6	Able to do implementation by using C++ programming.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM IV Computer Application (Voc.)	CO1	Understanding of the Elementary & Advanced Features of DBMS & RDBMS.
		CO2	Good Practical Understanding of the SQL.
		CO3	Prepare Various Database Tables using SQL Commands.
		CO4	Able to Develop Structured Query Language (SQL) Queries to Create, Read, Update, And Delete Relational Database Data.
		CO5	Should write PL/SQL program

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM V Computer Application (Voc.)	CO1	Understand the code solution and compile VB project in .NET framework.
		CO2	Design and develop console and windows base .NET applications.
		CO3	Learn about MS.NET framework developed by Microsoft.
		CO4	To develop, implement, and demonstrate Component Services, and Windows and web services.
		CO5	Able to get familiar with Java programming and to learn classes and objects.
		CO6	To learn programming using Java.
		CO7	Able to use Java Applets.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM VI Computer Application (Voc.)	CO1	To learn and understand advance concept of Java
		CO2	Able to write program using Exception Handling
		CO3	To learn the programming using Servlets and JSP.
		CO4	To learn Java Bean so as to make the reusable software components
		CO5	Be able to understand use of VB.NET basics, Objects and Types
		CO6	Be able to understand ADO.NET. Understand developing, implementing and creating Applications in VB.NET and database.

Course Code	Name of the Course	COs	After completing this course students must be able to
	BCA SEM I	CO1	Understands the basic concepts computers
		CO2	Learn basic programming techniques
		CO3	Able to access C programming tools
		CO4	Able to do implementation by using C programming tools
		CO5	Ability to understand Sets and their algebra, duality, power sets and partitions.
		CO6	Principle of Strong Mathematical Induction, Product sets 2.
		CO7	Ability to analyze various binary relations characteristic function and Recursive functions
		CO8	Ability to understand logical operators, Implications, Tautologies, validity of arguments, and quantifiers

	CO9	Ability to model problems using Graphs, connectivity, Rooted trees. Minimum Spanning Trees
	CO10	Devise a communication strategy

Course Code	Name of the Course	COs	After completing this course students must be able to
	BCA SEM II	CO1	To understand the fundamental concepts and techniques of Operating Systems.
		CO2	To study the concepts in process management and memory managements and deadlocks
		CO3	Able to do implementation by using advance C programming techniques.
		CO4	acquire the basic knowledge of digital logic levels and digital electronics circuits.
		CO5	Be able to specify and manipulate basic mathematical objects
		CO6	Able to communicate effectively orally and in writing.

Course Code	Name of the Course	COs	After completing this course students must be able to
	BCA SEM III	CO1	Should able to analyze algorithms.
		CO2	Understand searching and sorting techniques.
		CO3	Should understand stack, queue and linked list operation.
		CO4	Should get knowledge of tree and graphs concepts.
		CO5	Know the concepts of object-oriented programming
		CO6	Ability to design and develop Object Oriented systems
		CO8	Good Practical Understanding of the SQL, Prepare Various Database Tables using SQL Commands
		CO9	To learn the fundamentals of Operating Systems and the mechanisms of OS to handle processes

Course Code	Name of the Course	COs	After completing this course students must be able to
	BCA SEM IV	CO1	Compare the processes of developing and implementing information systems.
		CO2	Understand the IDE and design and develop applications in VB
		CO3	Understand the networking concept and Describe the functions of each layer in OSI
		CO4	Describe the architecture of microprocessor
		CO5	Design I/O circuits.

Course Code	Name of the Course	COs	After completing this course students must be able to
	BCA SEM V	CO1	To learn and understand advance concept of Java
		CO2	Able to write program using Exception Handling
		CO3	To learn the programming using Servlets and JSP.
		CO4	To learn Java Bean so as to make the reusable software components

		CO5	identify some of the factors driving the need for network security
		CO6	knowledge of Software Process Models and become aware of the Software Product.
		CO7	To acquire the background of Software Architecture.
		CO8	Have a basic understanding of the core concepts of computer graphics.

Course Code	Name of the Course	COs	After completing this course students must be able to
	BCA SEM VI	CO1	Create a Web form with server controls
		CO2	Can develop a client –server-based application.
		CO3	Should create multimedia applications
		CO4	Apply modern software testing processes in relation to software development and project management.
		CO5	Understanding of the Elementary & Advanced Features of DBMS & RDBMS
		CO6	Prepare Various Database Tables using SQL Commands

Course Code	Name of the Course	COs	After completing this course students must be able to
	M.Sc. SEM I Computer Software 1. Advanced Programming in JAVA	CO1	Learn Internet Programming, using Java Applets
		CO2	Create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit(AWT) & Swings
		CO3	Apply event handling on AWT and Swing components.
		CO4	Learn to access database through Java programs, using Java Database Connectivity (JDBC)
		CO5	Create dynamic web pages, using Servlets and JSP
	2. Software Engineering & Software Testing	CO1	Knowledge of Software Process Models and become aware of the Software Product.
		CO2	Manage incidents and risks within a project.
		CO3	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
		CO4	Distinguish characteristics of structural testing methods.
		CO5	Discuss about the functional and system testing methods.
	3. .Net Technology using ASP	CO1	Understand the code solution and compile VB project in .NET framework.
		CO2	Design and develop console and windows base .NET applications

		CO3	Students will be able to design web applications using ASP.NET
		CO4	Students will be able to use ASP.NET controls in web applications
		CO5	Students will be able to debug and deploy ASP.NET web applications.
	4. Computer Networks	CO1	Recognize the technological trends ofComputer Networking.
		CO2	Discuss the key technological components of the Computer Network.
		CO3	Evaluate the challenges in building networks and solutions to those.
		CO4	Identify the different types of network devices and their functions within a network.
		CO5	Understand and build the skills of subnetting and routing mechanisms.

Course Code	Name of the Course	COs	After completing this course students must be able to
	M.Sc. SEM II Computer Software 1. Programming in C#	CO1	knowledge of the structure and model of the programming language C # (note)
		CO2	Use the programming language C # for various programming technologies (understanding)
		CO3	Develop software in C # (application)
		CO4	Evaluate user requirements for software functionality required to decide whether the programming language C # can meet user requirements (analysis)
		CO5	propose the use of certain technologies by implementing them in the C # programming language to solve the given problem (synthesis)
	2.Distributed Operating System	CO1	To provide hardware and software issues in modern distributed systems.
		CO2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
		CO3	To analyse the current popular distributed systems such as peer-to-peer (P2P) systems will also be analysed.
		CO4	To know about Shared Memory Techniques.
		CO5	Have Sufficient knowledge about file access.
	3.Advanced Database Management System	CO1	Apply normalization techniques.
		CO2	Understand how transactions are processed in a database.
		CO3	Discuss/explain the concepts of Distributed Databases and Data Warehousing.
		CO4	Discuss/explain some database security issues.

	4.Fundamentals of Open Source Systems	CO1	Ability to install and run open-source operating systems.
		CO2	Ability to gather information about Free and Open Source Software projects from software releases and from sites on the internet.
		CO3	Ability to build and modify one or more Free and Open Source Software packages.
		CO4	Ability to use a version control system and to interface with version control systems used by development communities.
		CO5	Ability to contribute software to and interact with Free and Open Source Software development projects.

Course Code	Name of the Course	COs	After completing this course students must be able to
	M.Sc. SEM III Computer Software 1. Data Warehouse and Data Mining	CO1	Understand Data Warehouse fundamentals, Data Mining Principles.
		CO2	Design data warehouse with dimensional modelling and apply OLAP operations.
		CO3	Identify appropriate data mining algorithms to solve real world problems
		CO4	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
		CO5	Describe complex data types with respect to spatial and web mining.
		CO6	Benefit the user experiences towards research and innovation. integration.
	2.PHP Programming	CO1	Write PHP scripts to handle HTML forms.
		CO2	Write regular expressions including modifiers, operators, and metacharacters.
		CO3	Create PHP programs that use various PHP library functions, and that manipulate files and directories.
		CO4	Analyse and solve various database tasks using the PHP language.
		CO5	Analyse and solve common Web application tasks by writing PHP programs.
	3. Mobile Computing with Android	CO1	Demonstrate their understanding of the fundamentals of Android operating systems.
		CO2	Demonstrate their skills of using Android software development tools.
		CO3	Demonstrate their ability to develop software with reasonable complexity on mobile platform.
		CO4	Demonstrate their ability to deploy software to mobile devices.
		CO5	Demonstrate their ability to debug programs running on mobile devices
	4. Elective:	CO1	Understand the basic concepts of Computer Graphics.

	1. Computer Graphics 2. Compiler Construction	CO2	Demonstrate various algorithms for scan conversion and filling of basic objects and their comparative analysis.
		CO3	Apply geometric transformations, viewing and clipping on graphical objects.
		CO4	Explore solid model representation techniques and projections.
		CO5	Understand visible surface detection techniques and illumination models.

Course Code	Name of the Course	COs	After completing this course students must be able to
	M.Sc. SEM IV Computer Software 1.Cyber Security & Digital Forensic 2.Soft Computing 3.Web Content Management System Elective: 1. Cloud Computing 2. Design and Analysis of Algorithms	CO1	Understand and Analyse various computer forensics systems
		CO2	Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory
		CO3	Understand the use of MATLAB and working in MATLAB
		CO4	Understand content management systems so as to be able to create and host modern websites.
		CO5	Able to use Cloud Services and implement Virtualization
		CO6	Ability to analyse the performance of algorithms
		CO7	Ability to choose appropriate algorithm design techniques for solving problems.

Environmental Science Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. Sem I Environmental Science Paper 1S- Concept of Environmental Science	CO1	explain the basics of Environmental Science with scope and details about segments of Environment.
		CO2	Elaborate the concept of Natural Resources & its classification. Soil studies
		CO3	Demystify the fundamentals in Environmental meteorology.
		CO4	Explicate the roe of metrological parameter in environment.
		CO5	Explicate the concepts in Environmental Geosciences and study of Biomes.
		CO6	Understand the fundamentals in Marine Environment.elucidate the conceptofwate, soil and weather quality.
	B.Sc. Sem II Environmental Science Paper 2S- Ecology and Environmental	CO1	Understand the fundamental Concept and characteristics of Ecology.
		CO2	fundamental Concepts and characteristicsin Population Ecology.
		CO3	Demystify the systematic study and measurement of Community Ecology
		CO4	explain the basics of Ecosystem ant types.
		CO5	Explicate the basics of Productivity, types and measurement.
		CO6	Elaborate the parameters related to Biodiversity and Bio indicators.
	B.Sc. Sem III Environmental Science Paper 3S- Environmental Chemistry	CO1	fundamental Concept in Environmental Chemistry.
		CO2	Understand fundamental and Practical Concept in Chemistry of Biomolecules.
		CO3	Explicate fundamental Concept in Environmental Toxicology its evaluation and biomagnification.
		CO4	Explain concept and mechanism of Xenobiotic and Bioremediation.
		CO5	Elaborate the water chemistry and Chemical Speciation
		CO6	Elaborateand Understand fundamental and Practical Concept in Renewable energy resources.
	B.Sc. SemIVEnvironmental Science Paper 4S- Environmental Pollution	CO1	Understand Conceptsrelated to air, water, land, noise, radiation pollution with respect to their sources, types, Effects, application and control measures.
		CO2	Explain the Major Environmental issues and case studies
		CO3	Determination, Analysis and measurement of various pollutants from environmental segments.
	B.Sc. SemVEnvironmental Science **Paper 5S-** Pollution Control Technology	CO1	Explicate fundamental Concept in air pollution control by using various instrumental techniques. Determination of various parameter by using techniques.
		CO2	Explain physical, chemical and biological techniques to waste water so it can reuse.
		CO3	Understand Concepts related to methods handling, storage, transportation and disposal of solid, biomedical & radioactive waste treatment.

		CO4	Demystify the application of Personal Protective Equipment's at work place. Practical knowledge of Material Safety Data Sheet.
	B.Sc. SemVIEnvironmental Science Paper 6S- Environmental Conservation & Management	CO1	Explicatethe Concepts of environmental education & awareness. Role of mass media in awareness.
		CO2	Management and studies of Mining and conservation of wet land
		CO3	Management and Conservation of Biodiversity and Wild life with Environmental Laws.
		CO4	Explicatethe role of NGO and GO for Environmental conservation.
		CO5	Understand Concepts and application of EIA, Environmental Audit, and Application of GIS GPS and Remote sensing in Environmental pollution studies.
		CO6	Explain Sustainable development and application of tools of Bio Statics.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–I - Environmental Science-An InterdisplinaryApproachstudent must be able to
	M.Sc. SEM I – Paper I Environmental Science-An Interdisplinary Approach **Paper II-**Concept of Ecology and Biodiversity **Paper III-** Environmental Chemistry **Paper-IV-** Geodynamics and Energy Resources	CO1	Be aware about the Basic Principles & scope of Environmental Science, Sustainability, environmental attitudes and carrying capacity.
		CO2	Laws of Thermodynamics Earth as stemmas energy transfer across various interface and heat transfer process.
		CO3	be able to determine the Basic environmental problems. Geoscience, geochemistry in environmental problem. Major trace elements in tectonic plate movement process.
		CO4	be familiar with the most important City planning, urbanisation, concepts of waste disposal, integrated pest management and irrigation.
		CO5	have learned about minerals, environmental and environmental economics Concept of cost benefit analysis (CBA) and policy instruments.
		CO6	be aware of the concept, principles, types and scope of ecology. Relation to other science and to civilisation.Fundamentals of Environmental Chemistry.analytical environmental data.
		CO7	have received the basic concept & characteristics of population ecology. Environmental resistance to prey predator relationship. Distribution of population.
		CO8	understand the importance of biodiversity conservation. gain an understanding of Biodiversity action plan CBD and biodiversity act.
		CO9	be able to pursue the research work in the field of Ecological adaptation and ecological energetic and disasters. and nanotechnology.
	M.Sc. SEM II Paper- V- Bioinformatics in Environmental Analysis	CO 1	Aware about the application of biostatics,test of siginificance, Anova. Environmental system analysis and modelling.
		CO 2	have learned how to expand microbial application in recovery of environmental segments. industrial application of microorganism.
		CO3	Air and Noice pollution studies with respect to development of environmental model.

	Paper VI– Environmental Microbiology **Paper VII –** Air and Noise Pollution **Paper VIII-**Water Pollution	CO 4	Water quality studies with consideration of all aspects of water media.
		CO 5	Can apply the skill of environmental microbiology in bioremediation. They can operate very advanced and sophisticated instruments.
	M.Sc. SEM III **Paper IX-** Terrestrial Pollution **Paper X-** Remote Sensing, GIS and Computer Application **Paper IX-** Environmental Impact Assessment and Audit **Paper XII-** Pollution Control Technology	CO 1	have a good grasp of the terrestrial pollution in sources, composition, effects and management.
		CO 2	Can acquaint the recent knowledge of remote sensing, GIS and computer application.
		CO 3	Can well understand the process application of EIA and audit. Practical application of all the tools.
	M.Sc. SEM IV **Paper XIII-** Environmental Toxicology and Hazardous Waste Management **Paper XIV-** Industrial Hygiene and Safety **Paper XV-** Nature, Conervation and Environmental Management **Paper XVI-** Environmental Polices and Legislation	CO 1	Aware about the theoretical and practical knowledge of environmental toxicological management.
		CO 2	Importance and need of industrial hygiene and safety.Field based projects provide good exposure to the studets.
		CO 3	Nature conservation and management through environmental policies and legislation

Geology Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM I Geology	CO1	Explain the Rock Weathering and their types of weathering
		CO2	Explain and understand the concept of Volcanism, Earthquake and their causes, types and explain mountain building process.
		CO3	Identification of Minerals samples through use of Physical & microscopic properties of mineral and these enable students for field identification of minerals which is most essential part for Rock Identification, anomaly study and research purposes.
		CO4	Explain and visualization the concept of elements of symmetry in the crystals of normal seven classes.
		CO5	Toposheet reading and interpretation which is preliminarily requirement for Geological reconnaissance survey, field planning, locating study area on map and also used as a base map for digitization in GIS environment.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM II Geology	CO1	Megascopic Identification of Igneous Rocks on the basis of mineralogical composition, their textural arrangement and groundmass.
		CO2	Megascopic Identification of Sedimentary Rocks on the basis of mineralogical composition, their textural arrangement and groundmass
		CO3	Megascopic Identification of Metamorphic Rocks on the basis of mineralogical composition, their textural arrangement and groundmass
		CO4	Explain sedimentary depositional Environment and their types.
		CO5	Identification of rocks in field is the crux for a Geologist. Rocks in thin section are studied under petrological microscope for detail Identification of rocks and mineralogical composition and inter-arrangement of minerals in rocks.
		CO6	Exercise on ACF, AKF and AFM diagrams which are used for plotting unknown rock sample's chemical composition and for interpretations of geochemical data.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM III Geology	CO1	Major stratigraphic division with description and Fossil study which is used for study of evolution of earth and its surface, for study of sequential arrangement of rock strata according to age of formation and important fossil used for stratigraphy establishment.
		CO2	Understand fossilization, modes of preservation, significance of fossil.

	CO3	Understand Classification of animal fossil and Micropaleontology.
	CO4	Understand Phylum – Mollusca, Brachiopod with their characteristics features and their classification.
	CO5	Understand Phylum – Echinodermata, Coelenterate with their characteristics features and their classification.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM IV Geology	CO1	Explain and understand erosional structures & unconformity and their types, recognition on the field.
		CO2	Explain and understand stress, strain, types of deformation, determination of stress by initial spherical objects.
		CO3	Structural Geology Problems where cross-section maps are prepared with the use of available exposures orientation which are useful in underground rock orientation predication which is used for civil engineering constructions like dam, tunnels and roads. Structural Geology problems are also used for mining and drilling exploration
		CO4	Understand different structures like fold, fault, joint and their geometric and genetic classification
		CO5	Understand the concept of Plate tectonics, continental drift theory, sea floor spreading, Palaeomagnetism, types of mountain and their formation
		CO6	Explain Geomorphology and their fundamental concept, processes, morphometric analysis.
		CO7	Understand Geomorphological Landforms and their types and explain applied geomorphology and tools of geomorphologist.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM V Geology	CO1	Economic Geology study where economic important minerals are specially studied with physical properties, maps are prepared for different economic deposits and special exploration
		CO2	Identification and understand the ore mineral & Industrial, metallic and non-metallic minerals and their properties, uses, mode of occurrence and types.
		CO3	Understand mineral exploration and prospecting. Understand surface & subsurface method and their types and their applications.
		CO4	Ore reserve calculation problems this are very important estimations which is to be done before mining activity which will lead to profit and loss calculation for mining activity.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM VI Geology	CO1	Hydrogeology studies various hydro chemical and hydro physical parameters which are studied for predication of movement, availability and dynamics of surface and groundwater and its contents as it is much dependent upon geomorphology of the area, rocks and geological structures.
		CO2	Various Recharge structures are studied and those are used for rain water harvesting

	CO3	Remote Sensing study of Arial photographs and satellite images which are used in predication on the earth's surface various parameters which are used for geological predictions remotely.
	CO4	Engineering Geology studies various engineering properties of rock and engineering structure like tunnel, dam, etc.
	CO5	These engineering properties are useful for study of constructing site and such as great importance in safe, stable designs of the engineering projects. Geological Skill studies useful for geological skill development.

Mathematics Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc I SEM I Maths Paper I : **Algebra and Trigonometry**	CO1	Apply De Moivre's theorem to solve problems on roots.
		CO2	Have full knowledge of Trigometric series, Gregory series, Euler's series, Machin's series, Rutherford series.
		CO3	Find the characteristic equation, eigen values and correspondinig eigen vectors of a given matrix
		CO4	Find the coefficients of quadratic equations by using relation between roots and coefficients of equations
		CO5	Find the inverse of square matrix.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc I SEM I Maths Paper II: Differential and integral Calculus	CO1	Have full knowledge of limit and continuity for study the functions
		CO2	Study differentiability to apply it for day to day problems.
		CO3	know the geometrical applications of mean value theorems.
		CO4	study the difference between ordinary and partial differentiation.
		CO5	Find nth derivative of product of two functions using Leibnitz's theorem and study integration for finding values of product of functions.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc I SEM II Maths Paper III	CO1	Solve first order differential equation using different techniques
		CO2	How to find the solution of linear and differential equations of second order with constant coefficients.
		CO3	Students will be introduced to the complete solution of non-linear differential equations by using different method
		CO4	Students must know the methods of solving partial differential equations for more than one variable
		CO5	Students will study applications of differential equations.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc I SEM II Maths Paper IV	CO1	Students have knowledge about the vectors, their products, differentiation and integration.
		CO2	They study divergence, curls directional derivative which are useful in physics.
		CO3	Students have knowledge about integration which will be used to calculate the area under the curve
		CO4	Students studied the concepts of Geometry.

	CO5	They study sphere, cone and Cylinder.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. II SEM III Maths Paper V	CO1	Students learn about sequence and their convergence using different test
		CO2	They have the knowledge of calculating the sum of infinite number of terms
		CO3	Students know that how to work on functions of two or more variables.
		CO4	Students aware about the application of extremum value problem to solve industrial, society problems.
		CO5	To solve the double and triple integrations.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc II SEM III Maths Paper VI	CO1	Students learn about divisibility, prime numbers, congruence, quadratic reciprocity, Diophantine .
		CO2	Learn methods and techniques used in number theory.
		CO3	Write programs / functions to compute number theoretic functions.
		CO4	Use mathematical induction and other types of proof writing techniques.
		CO5	Students are able to effectively communicate mathematics.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc II SEM IV Maths Paper VII	CO1	Have knowledge of algebraic structures groups, rings.
		CO2	Know definition of homomorphism, isomorphism, and natural homomorphism.
		CO3	Algebra of ideals, prime ideal, principal ideal, and quotient rings.
		CO4	Knowledge of ring, integral domain, field.
		CO5	Extend group structure to finite permutation group.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc II SEM IV Maths Paper VIII	CO1	Knowledge of degree of freedom generalized coordinates and constraints.
		CO2	Knowledge of solving the problems of motion of a system of particles.
		CO3	Kepler's problem to know the universe.
		CO4	Variation techniques for extremum.
		CO5	Different principles to study motion of particles.
		CO6	To study motion of a rigid body.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc III SEM V Maths.Paper IX	CO1	To solve examples of improper integral.
		CO2	Students will be introduced to the concept of continuity of complex functions
		CO3	Students will have a working knowledge of differentiability for complex functions and be familiar with the Cauchy - Riemann equations.
		CO4	Students will be introduced to metric spaces, cauchy sequences.
		CO5	Understand purpose and functions of the gamma and beta functions.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc III SEM V Maths Paper X	CO1	Students will have full knowledge of Legendre's equation.
		CO2	The students are expected to learn Bessel's equation, generating function for Jn (x), Sturm Lowville boundary value problem.
		CO3	Understand Fourier series.
		CO4	Apply Laplace transform to solve ordinary and partial differential equation.
		CO5	to understand Fourier transform

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM VI Maths Paper XI	CO1	To solve examples of improper integrals
		CO2	Students will be introduced to the concept of continuity of complex function.
		CO3	Students will have a working knowledge of differentiability for complex functions and be familiar with the Cauchy - Riemann equations.
		CO4	Students will be introduced to metric spaces, Cauchy sequences.
		CO5	Understand purpose and functions of the gamma and beta functions.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM VI Maths Paper XII	CO1	Use tensor notation in relativity theory.
		CO2	Apply the concept of length contraction and time dilation as well as use Lorentz transformation .
		CO3	Solve simple kinematical problems.
		CO4	Analyze Maxwell's equations and use their relativistic invariance.
		CO5	Compute basic quantities in differential geometry.

	CO6	Analyze Einstein's Field equations.

Microbiology Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM I Microbiology	CO1	To understand discovery of microscope, controversy over spontaneous generation, germ theory of diseases,pure culture concept.
		CO2	To understand Objectives and its functions, oil immersion objectives ,condenser and its functions. To know principles, construction, ray diagram and applications of compound, dark field, phase, fluorescent microscope.
		CO3	To know staining and types of staining bacterial classification.To understand general characteristics of viruses, fungi, actinomycetes, mycoplasma and algae.
		CO4	To know structural organization of bacteria and understand microbial nutrition, pure culture technique . To understand reproduction and growth of bacteria.
		CO5	To understand construction, operation and utility of laboratory instruments as well as understand different parts, use and care of compound microscope.
		CO6	. To prepare nutrient broth, nutrient agar and PDA. To demonstrate of bacteria from soil, water, air, milk and skin by experimental methods.
		CO7	To demonstrate osmosis and diffusion and how to perform streak plate method, pour plate and spread plate method. To demonstrate replica plate technique by experimental methods.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM II Microbiology	CO1	To understand discovery, structure, classification of viruses. cultivation of viruses..To study physical and chemical control viruses.
		CO2	To understand environmental microbiology. To understand basic biochemistry.
		CO3	To study structure, classification and types of biomolecules To understand mechanism of cell injury.
		CO4	.To understand biostatistics. To explain computer concepts.
		CO5	Effect of salt and sugar concentration, pH and temp on bacterial growth. Demonstration of oligodynamic action.
		CO6	.To perform slide culture technique of fungi. To demonstrate antibiotic sensitivity testing.

	CO7	Use of Ms- excels.To understand use of internet. Statistical data processing by performing it practically.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM III Microbiology	CO1	To understand concept of gene, Replication of DNA and DNA repair mechanisms. To explain Genetic code and its characteristic features and outline of protein synthesis- Transcription and Translation
		CO2	To know gene regulation mechanisms- lac operon and trp operon. To explain Mutation – definition and types, and molecular basis of spontaneous and induced mutation.
		CO3	To explain transfer of genetic material in prokaryote- Transformation, Transduction and conjugation. To understand basic technique of genetic engineering.
		CO4	To understand isolation of genomic and plasmid DNA from bacteria. To know definition, method and applications of gene mapping, DNA sequencing and PCR.
		CO5	To explain applications of genetic engineering in health care and agriculture biotechnology, environmental and industrial biotechnology
		CO6	To isolate genomic DNA from bacteria. To perform Agarose gel electrophoresis
		CO7	To perform genetic recombination in bacteria – 1. Transformation 2. Conjugation To estimate DNA and RNA.
		CO8	To isolate fermentative mutant using physical mutagen (U.V. radiation) and To detect streptomycin resistant mutant by replica plating technique by experimental methods.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM IV Microbiology	CO1	To understand definition, classification and scope of epidemiology also types of infection and modes of transmission. To understand normal flora of human body microbial virulence factors- toxin and enzymes and control of communicable diseases.
		CO2	To understand organs and cells of immune system. To know general nonspecific factors, innate immunity and acquired immunity, immune response and hypersensitivity. To explain antigen and antibody- definition, types structure, classification of antibodies, monoclonal antibodies.
		CO3	To know about antigen – antibody reactions- agglutination, precipitation, complement fixation test, ELISA and RIA.
		CO4	To study various bacteria with respect to their morphology, cultural and biochemical properties, pathogenesis, laboratory diagnosis and prophylaxis – *S. aureus, C.tetani, S. typhi, M. tuberculosis, T. pallidum, V. Cholera.*

	CO5	To understand other pathogenic organisms- Viruses, Rickettsia, Protozoa, Fungi.
	CO6	To perform microbial enzymes and biochemical tests- urease, coagulase, oxidase, IMVic and sugar fermentation. To isolate and identification of *S.aureus, E. coli, S. typhi*
	CO7	To perform serological tests like Widal, pregnancy test and VDRL. To perform antibiotic sensitivity test by disc diffusion method.
	CO8	To perform cultural examination of urine. Blood, sputum, stool, pus and CSF. To isolate pathogenic fungi.
	C09	To detect blood grouping and cross matching. To detect blood glucose and cholesterol.
	C10	To estimate hemoglobin. To test carbohydrates and proteins in urine by performing practically.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM V Microbiology	CO1	To understand positive and negative microbial associations. To know air microbiology and airborne diseases and its control .
		CO2	To explain Microbiology of soil. To understand nitrogen cycle, Caron cycle and sulphur cycle.
		CO3	To know water microbiology. To understand eutrophication and its control. To know bacteriological analysis of water and its significance.
		CO4	To understand ICMR and WHO bacteriological standards of drinking water. To know self purification of water and treatment of water.
		CO5	To understand slow and rapid sand filters and methods of chlorination. To explain preliminary, primary and secondary treatment of waste water treatment. To understand bioinstrumentation.
		CO6	To perform bacteriological analysis of water and waste water.. To understand effect of ultra violet radiation on microorganisms present in water.
		CO7	To enumerate soil microorganisms. To isolate Aotobacter and Rhizobium from soil. To isolate antibiotic producers from soil.
		C08	To perform paper chromatography for separation of biomolecules.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM VI Microbiology	CO1	To understand important classes of industrial microorganisms. To understand general fermentation process in detail.
		CO2	To know detailed fermentation process for production of beer and wine, Actone –butanol, Citric acid and Vinegar, single cell protein and amylase, Penicillin and Vitamin B 12
		CO3	To explain Sources of milk contamination, microbial spoilage of food and preservation of food. To describe various Fermented food and its advantages, food poisoning and indicators of food contamination as per WHO.
		CO4	To explain Nature, definition, classification and nomenclature of enzymes. To understand various terminologies used in enzymology like active site, substrate, co- enzyme, cofactor, prosthetic group, apoenzyme, isoenzyme, allosteric enzyme, immobilized enzyme, activation energy.
		CO5	To perform microbiological examination of milk by various experiments like plate count, MBRT, phosphate test, test for coliform, milk testig for adultration.
		CO6	To estimate fats of milk. To perform demonstration of microbes in curd.
		CO7	To perform laboratory scale production of citric acid, amylase To perform immobilization of enzyme
		CO8	To perform production of wine from grapes
		C09	To examine microbiological quality if vegetables, fruits and fast foods by plate count, test for coliform and test for yeast and moulds.

Physics Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM I Physics	CO1	explain the basics of Kepler's laws, Newtons law, Gauss theorem and its application;
		CO2	explain linear momentum , angular momentum and moment of inertia(MI) of the bodies and determination of MI with the help of principal of perpendicular and parallel axis
		CO3	explain fundamentals of harmonic oscillator model, including damped and forced oscillators and grasp the significance of terms like quality factor and damping coefficient
		CO4	understand the principal of superposition of SHM, determination of velocity of wave using kunds tube
		CO5	understand elastic properties of materials, concept of bending behaviour of beam and determination of elastic modules of given structure
		CO6	understand viscous properties of fluids and applications of the Bernoullis theorem
		CO7	understand the concept of surface tension and to determine of surface tension by experimental methods.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM II Physics	CO1	explain kinetic theory of gases and its implications familiarised with the thermodynamic parameters
		CO2	understand the various thermodynamic process and work done in each of these process.
		CO3	understanding about Reversible and irreversible process and also working of a Carnot engine, and knowledge of calculating change in entropy for various processes
		CO4	understand the importance of Thermo dynamical functions and applications of Maxwell's relations.
		CO5	understand the basic concept of motion of charge particle under electric and magnetic field.
		CO6	apply the knowledge of basic circuital law and simplify the network using reduction techniques
		CO7	analyze the circuit using Kirchhoff's law and Network simplification theorems like Thevenin's theorem, Norton's theorem, Superposition theorem, Milliman's theorem, etc
		CO8	obtain the maximum power transfer to the load
		CO9	analyse the AC circuits and understand the principle and operation of transformer.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM III Physics	CO1	familiarized with gradient, divergence and curl of scalar and vector fields and their physical significances.evaluate the electrostatic fields and potential in free space.
		CO2	understand the production of magnetic field due to steady current and calculate magnetic fields using Boit-Savart and Ampere's law
		CO3	understand the Maxwell's equation of electrodynamics, its applications to propagation of electromagnetic waves and significance of Poynting theorem (vector)
		CO4	formulate and solve the basic science problems on electromagnetism
		CO5	explain the physical principles and applications of Electronics
		CO6	understand the nature of semiconducting materials and the physics that influences the presence of charge carriers in a semiconductor
		CO7	describe the factors that influence the flow of charge in semiconductors and the operation of semiconductor devices
		CO8	familiarized with the operation of circuits based on diodes, bipolar transistors, and field effect transistors
		CO9	using the test equipment such as a Function Generator, an Oscilloscope, a digital Multimeter, and variable Power Supplies
		CO10	understand the thermodynamic principles of atmospheric processes, physical processes and physical properties of the Earth and its surrounding space environment

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM IV Physics	CO1	generate the ability to predict behavior of optical instruments using geometric and wave approaches;
		CO2	formulate their understanding of fundamental optics to articulate the concepts and operating principles of super-resolution optical microscopes
		CO3	understand the phenomenon of Interference, diffraction and polarization and toanalyze the intensity variation of light due to this effect
		CO4	understanding of optics and quantum mechanics to articulate the operational principles of lasers and the unique properties of laser light
		CO5	explain working principle of lasers and its applications
		CO6	explain working principles of optical fibre and its use in communication
		CO7	explain solar energy radiation, solar collectors, energy conversion systems and also power generation using geothermal and wind energy

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM V Physics	CO1	familiar with the main aspects of the historical development of quantum mechanics and be able to discuss and interpret experiments that reveal the wave properties of matter, as well as how this motivates replacing classical mechanics with a wave equation
		CO2	understand the central concepts and principles in quantum mechanics, such as the Schrödinger equation, the wave function and its statistical interpretation, the uncertainty principle, stationary and non-stationary states
		CO3	solve the Schrödinger equation on their own for simple systems in one to three dimensions
		CO4	understand the vector atom model and apply its principles to the study of atoms and its behaviour, origin of X- ray spectra andits characteristics.
		CO5	explain Raman effect and its importance as spectroscopic technique
		CO6	understand the structure of atomic nuclei basic properties of a nucleus such as binding energy and nuclear forces
		CO7	understand the basic properties of a nucleus such as binding energy and nuclear forces
		CO8	understand mechanism of decay process of alpha beta and gamma particles
		CO9	familiar the process of nuclear fission and fusion and concept of particle detector and accelerators
		CO10	explain the concept of feedback in amplifiers design and analysis of amplifier and oscillator using BJT.

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM VI Physics	CO1	understand the concept of microscopic and macroscopic states and relationship between thermodynamics and statistics
		CO2	familiar with classical (Maxwell-Boltzmann) statistics and quantum statistics (Bose and Fermi Dirac) statistics and able to apply for different systems of particles
		CO3	distinguish amorphous and crystalline solids
		CO4	knowledge of crystal systems and spatial symmetriesand how crystalline materials are studied using diffraction. calculate thermal and electrical properties in the free-electron model
		CO5	explain the concept of energy bands and effect of the same on electrical properties, various types of magnetic phenomenon, physics behind them and their properties
		CO6	superconductivity, its properties, important parameters related to possible applications
		CO7	understand the concept of nanomaterials and the effect of increase in S/V ratio on the properties of materials
		CO8	understand the concept of quantum confinement and its consequences

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–I - Mathematical Physics students must be able to
	M.Sc. SEM I - Mathematical Physics	CO1	have a good grasp of the basic elements of complex analysis, including the important integral theorems;
		CO2	be able to determine the residues of a complex function and use the residue theorem to compute certain types of integrals;
		CO3	be able to solve ordinary second order differential equations important in the physical sciences; solve physically relevant partial differential equations using standard methods like separation of variables, series expansion (Fourier-type series) and integral transforms;
		CO4	be familiar with the most important special functions to solve mathematical problems of physics;
		CO5	have learned how to expand a function in a Fourier series, and under what conditions such an expansion is valid;
		CO6	be aware of the connection between this and integral transforms (Fourier and Laplace) and be able to use the latter to solve mathematical problems relevant to the physical sciences;
		CO7	have received basic training in matrix algebra. You will be familiar with examples of how to formulate certain theory / physical laws in terms of matrix, and how to simplify them using matrix algebra.
		CO8	be able to understand the physics behind structural properties of the solids;
		CO9	be able to tailor the properties of solids with proper understanding;
		CO10	be able to pursue the research work in the field of material science and nanotechnology.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–I - Classical Mechanics students must
	M.Sc. SEM I - Classical Mechanics	CO1	be able to understand the fundamental concepts of dynamics of a system of particles;
		CO2	gain the familiarity with basic ideas of motion in central potential, small oscillations, kinematics and dynamics of rigid bodies;
		CO3	be able to describe and understand the motion of a mechanical system usng Lagrange-Hamilton formalism;
		CO4	be able to solve the two body and many body problems using classical physics;
		CO5	be able to solve the central force problems and equations of orbits of planets;
		CO6	be able to solve and obtain canonical equations and to use Poisson's brackets.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–I - Quantum Mechanics-Istudents must be able to
	M.Sc. SEM I - Quantum Mechanics-I	CO1	be familiar with the main aspects of the historical development of quantum mechanics and be able to discuss and interpret experiments that reveal the wave properties of matter, as well as how this motivates replacing classical mechanics with a wave equation;

		CO2	be able to understand the central concepts and principles in quantum mechanics, such as the Schrödinger equation, the wave function and its statistical interpretation, the uncertainty principle, stationary and non-stationary states, time evolution of solutions, as well as the relation between quantum mechanics and linear algebra. This includes an understanding of elementary concepts in statistics, such as expectation values and variance;
		CO3	be able to solve the Schrödinger equation on their own for simple systems in one to three dimensions, both analytically and by using robust numerical methods;
		CO4	be able to use these solutions to calculate their time evolution, associated probabilities, expectation values, and uncertainties, as well as give concise physical interpretations and reasoning underlying the mathematical results;
		CO5	have mastered the concepts of angular momentum and spin, as well as the rules for quantisation and their additions;
		CO6	be able to distinguish between Schrodinger, Heisenberg and Interaction representations;
		CO7	befamiliar with various approximation methods andable to apply Variation method to obtain the ground state energy of various systems and WKB method for one dimensional problems.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–I - Computational Method & Programming students must be able to
	M.Sc. SEM I - Computational Method & Programming	CO1	be able to apply mathematical methods to solve problems in classical mechanics, statistical mechanics, quantum mechanics and electrodynamics;
		CO2	be able to numerically, solve ordinary differential equations with boundary value problems;
		CO3	be learn numerical methods for interpolation, finding roots of equations
		CO4	be able to integrate a function within limits of given interval and hence to estimate the area under the curves;
		CO5	be able to iteratively finds the roots of smoothly varying functions with nonzero derivatives;
		CO6	be able to identify and describe the characteristics of various numerical methods;
		CO7	be able to independently program computers using leading-edge tools (C-programming);
		CO8	be able to formulate and computationally solve the selected problems in physics using C-programming.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–II - Electrodynamics -I students must be able to
	M.Sc. SEM II - Electrodynamics **-I**	CO1	be able to evaluate the electrostatic fields and potential in free space and in different media;
		CO2	be able to evaluate configuration energy of an electrostatic system;
		CO3	be able to understand the production of magnetic field due to steady current and calculate magnetic fields using Boit-Savart and Ampere's law;
		CO4	be able to understand the Maxwell's equation of electrodynamics, its applications to propagation of electromagnetic waves and significance of Poynting theorem (vector);

CO5	be able to use Maxwell equations in analysing the electromagnetic field due to time varying charge and current distribution;
CO6	be able to describe the nature of electromagnetic wave and its propagation through different media and interfaces;
CO7	be acquire a sense of unity in physics at a fundamental level by embracing the concepts of special relativity as emerged through the laws of electrodynamics and equipped with the necessary mathematical concepts to be able to solve relative problems.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–II - Quantum Mechanics-II students must be able to
	M.Sc. SEM II - Quantum Mechanics-II	CO1	be familiar with the perturbation theory and its types;
		CO2	be able to derive from first principles the expression for the first order energy shift due to a perturbation;
		CO3	be able to solve the time independent perturbation problems for quantum systems;
		CO4	be able to recognize and apply the perturbative expressions for the first order wave function and second order energy shift;
		CO5	be able to solve the time dependent perturbation problems for quantum systems and predict the consequences;
		CO6	be able to explain the quantum theory of scattering and use it to solve different scattering problems;
		CO7	be able to account for the phenomena involved in the Zeeman effect and spin-orbit coupling, what is meant by identical particles and quantum statistics, and you are able to perform calculations on systems of identical particles, for example to determine the symmetry properties of the wave function and total spin;
		CO8	be able to explain the physical properties of elementary particles, nucleons, atoms, molecules and solids based on quantum mechanics;
		CO9	be able to explain the relativistic quantum mechanical equations, namely, Klein-Gordon equation and Dirac equation;
		CO10	be familiar with various approximation methods applied to atomic, nuclear and solid-state physics.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–II - Solid State Physics students must be able to
	M.Sc. SEM II - Solid State Physics	CO1	be able to account for interatomic forces and bonds;
		CO2	have a basic knowledge of crystal systems and spatial symmetries;
		CO3	be able to account for how crystalline materials are studied using diffraction, including concepts like form factor, structure factor, and scattering amplitude;
		CO4	know the principles of structure determination by diffraction;
		CO5	understand the concept of reciprocal space and be able to use it as a tool;
		CO6	know the significance of Brillouin zones;

		CO7	know what phonons are, and be able to perform estimates of their dispersive and thermal properties;
		CO8	be able to calculate thermal and electrical properties in the free-electron model;
		CO9	know Bloch's theorem and what energy bands are;
		CO10	know the fundamental principles of semiconductors, including pn-junctions, and be able to estimate the charge carrier mobility and density;
		CO11	be able to account for what the Fermi surface is and how it can be measured;

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–II - Network Theorems &Solid State Device students must
	M.Sc. SEM II - Network Theorems &Solid State Device	CO1	be able to apply the knowledge of basic circuital law and simplify the network using reduction techniques;
		CO2	be able to analyze the circuit using Kirchhoff's law and Network simplification theorems like Thevenin's theorem, Norton's theorem, Superposition theorem, Milliman's theorem, etc.;
		CO3	be able to infer and evaluate transient response, steady state response, network functions and analyze the series resonant and parallel resonant circuits;
		CO4	be able to obtain the maximum power transfer to the load;
		CO5	be able to explain and understand the physical concepts underlying the operation of semiconductor devices;
		CO6	be able to analyze carrier flow and associated fields due to drift, diffusion, generation, and recombination;
		CO7	be able to draw and interpret energy band diagrams;
		CO8	be able to understand and analyze the behavior of a pn junction (diode), including device physics, device operation, and device characteristics;
		CO9	be able to understand how device design affects performance;
		CO10	be able to understand and analyze the behavior of field effect transistor (FET), including device physics, device operation, and device characteristics. Understand how device design affects performance;
		CO11	be able to design and analysis of amplifier using BJT, FET and MOSFET;

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–III - Electrodynamics –II & Plasma Physics students must be able to
	M.Sc. SEM III - Electrodynamics –II & Plasma Physics	CO1	be able to explain charged particle dynamics and radiation from localized time varying electromagnetic sources;
		CO2	be familiar with concepts of plasma physics;
		CO3	be able to understand the concept of wave guide and basic concept of plasma and confinement;
		CO4	be able to solve the problems in electrodynamics through, somewhat advanced level mathematics, and resolving them through the fundamental equations.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–III - Statistical Mechanics students must be able to
	M.Sc. SEM III - Statistical Mechanics	CO1	be able to understand the concept of microscopic and macroscopic states and relationship between thermodynamics and statistics;
		CO2	know about different types of ensembles;
		CO3	become familiar with classical (Maxwell-Boltzmann) statistics and quantum statistics (Bose and Fermi Dirac) statistics and able to apply for different systems of particles;
		CO4	gain knowledge on the concepts of phase transitions and super fluidity;
		CO5	be able to understand non equilibrium processes.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–III - Atomic & Molecular Physics students must be able to
	M.Sc. SEM III - Atomic & Molecular Physics	CO1	understand the vector atom model and apply its principles to the study of atoms and its behavior;
		CO2	understand spectroscopy of the hydrogen and alkali atoms;
		CO3	understand of quantum behaviour of atoms in external electric and magnetic fields;
		CO4	recognize the spectroscopy of many electron atomic systems and hyperfine splitting of spectral lines
		CO5	understand Resonance Spectroscopy (ESR and NMR) ;
		CO6	be able to apply knowledge to detailed understanding of vibrational-rotational spectroscopy of diatomic molecules, isotope shifts;
		CO7	be able to describe the detailed concept of Infrared and Raman spectra of Polyatomic molecules;
		CO8	be able to understand selection rules to explain transitions;
		CO9	be able to describe apply knowledge to detailed understanding of electronic states of atoms, molecules, Franck-Condon factors;

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–III - Condensed Matter Physics-I students must be able to
	M.Sc. SEM III - Condensed Matter Physics-I	CO1	be comprehend the scope of Condensed Matter Physics;
		CO2	be able to differentiate between different Lattice types and explain the concepts of reciprocal lattice and crystal diffraction;
		CO3	be able to predict electrical and thermal properties of solids and explain their origin;
		CO4	be able to explain the concept of energy bands and effect of the same on electrical properties;
		CO5	be able to describe the dielectric properties of insulators;

	CO6	be able to explain various types of magnetic phenomenon, physics behind them, their properties and applications;
	CO7	be able to explain superconductivity, its properties, important parameters related to possible applications.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–IV - Nuclear & Particle physicsstudents must be able to
	M.Sc. SEM IV - Nuclear & Particle physics	CO1	be able to understand the structure of atomic nuclei;
		CO2	understand the basic properties of a nucleus such as binding energy and nuclear forces;
		CO3	understand mechanism of decay process of alpha beta and gamma particles
		CO4	familiar the process of nuclear fission and fusion and concept of particle detector and accelerators;
		CO5	acquire knowledge of nuclear models;
		CO6	be able to classify elementary particles
		CO7	be able to understand the basic properties of elementary particles and various conservation rules for generation of elementary particles.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–IV - Condensed Matter Physics-II students must be able to
	M.Sc. SEM IV - Condensed Matter Physics-II	CO1	learn about different type of defects in crystals and their consequences;
		CO2	be able to understand the physics behind structural properties of the solids;
		CO3	be able to tailor the properties of solids with proper understanding;
		CO4	be able to pursue the research work in the field of material science and nanotechnology.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–IV - Op-Amp theory &Its Application students must be able to
	M.Sc. SEM IV - Op-Amp theory &Its Application	CO1	be familiarized with differential amplifier, its configurations and DC/AC analysis;
		CO2	be familiarized with basic integrated circuit components, its designing & packaging;
		CO3	be familiarized with basic integrated circuit components, its designing & packaging;
		CO4	be able to design the signal generators and low and high order filters;
		CO5	be able to understand and design of multi-vibrator, ADC and PLL circuits.

Course code	Name of the course	COs	After completing the course, "M.Sc. Sem–IV - Nanosciences& Nanotechnology students must be able to
	M.Sc. SEM IV – Nanosciences & Nanotechnology	CO1	be able to understand the concept of 1D, 2D, 3D nanomaterials;
		CO2	be able to understand the concept of quantum confinement and its consequences;
		CO3	acquire the knowledge on preparation and characterization techniques;
		CO4	acquire knowledge on different types of nanomaterials;
		CO5	be able to apply the knowledge to prepare and characterize novel nanomaterials;
		CO6	be able to understand practical applications of nanomaterials to design and fabricate nano devices;
		CO7	acquire the knowledge of Carbon nano-tubes and its potential uses.
		CO8	be able to pursue the research work in the field of material science and nanotechnology.

Statistics Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM I Statistics	CO1	Understanding scope of subject in regards to various fields
		CO2	Be able to understand what & how statistical organization work on central and state level
		CO3	Be able to understand data types, there measurement & collection of data
		CO4	Be able to clarify, tabulate and summarize data using central tendency & variation in data
		CO5	Everyone will able to make certain decision about the future, which involves uncertainly elements.
		CO6	Compute the mean or expected value of th random variable where weight are the probabilities associated with the corresponding values.
		CO7	Understand various types of generating function, probability generating function.
	B.Sc. SEM II Statistics	CO1	1) Be able to understand and compute correlation between two variables
		CO2	2) Be able to construct relationship in variables using regression techniques
		CO3	3) be able to compare new & compute correlation for attribute data
		CO4	4) Gives us a law according to which different values of random variable are distributed with specified probabilities according to some definite law which can be expressed mathematically.
		CO5	5) Different laws expressed mathematically for discrete as well as continuous random variable.
	B.Sc. SEM III Statistics	CO1	Preparation of random data in a systematic / tabular data
		CO2	Correct measures in Census organization
		CO3	Demographic pattern of a certain region
		CO4	Mortality / Fertility pattern of a certain region
		CO5	Framing of Objective / Hypothesis in research methodology
		CO6	Minimization of errors in research
		CO7	Formation of random sample using standard distribution
		CO8	Idea about testing the difference between observed & theoretical frequencies
		CO9	Procedure to obtain various moments of discreet /continuous distribution
	B.Sc. SEM IV Statistics	CO1	Importance of exact sampling distribution in statistical inferences
		CO2	Uses of t distribution for single mean, two means & pairwise observation

		CO3	Application of f test for testing equality of population variance
		CO4	Difference between large & small sample test and its uses
		CO5	Difference between parametric & non prametric test & its utility
		CO6	Various price & quantity index no & its uses
		CO7	Importance of Consumer Index no
		CO8	Measurement of trend, seasonal variation using various method
		CO9	Concept of demand analysis
	B.Sc. SEM V Statistics	CO1	Understand importance of quality measurement in industry
		CO2	Be able to construct charts for maintaining quality like x,rp,c,d, etc.
		CO3	Understand acceptance sampling plans for quality maintenance in industry
		CO4	Understand consumer problem solution approaches adopted function consumer problem
		CO5	Understand partial elasticises & Pareto curve
		CO6	Advantages of sample survey over census survey
		CO7	Simplest procedure of sampling, usually used in day today life
		CO8	Classification of various sampling units into different strata such as age ,sex, education or income level, geographical area
		CO9	Commonly employed technique if the complete and up to date list of the sampling units is available
	B.Sc. SEM VI Statistics	CO1	Understand optimization problem structure & solution methods adopted
		CO2	Understand problem of transportation & obtain its initial solution by various methods
		CO3	Understand assignment problem & sequencing problem & solution methods
		CO4	Implementation of game theory to market problem
		CO5	Statistical tool for test of significance when we have three or more samples to consider at a time
		CO6	In design of experiment student will confine themselves to the study of some of the simple but highly useful types of experimental design frequently employed in business, economics and scientific researches.
		CO7	Factorial experimental indicates the effect of several factors of variation are studied and investigated simultaneously.

Zoology Department

Course Code	Name of the Course	COs	After completing this course students must be able to
	B.Sc. SEM I Zoology	CO1	Explain the basics of Origin of organisms and its application in Non-chordates. Understanding the morphology and functional characteristics at cellular and sub-cellular (molecular) level.
		CO2	Explain Phylum-Protozoa, Lifecycle of Plasmodium vivax, Study of Parasitic Protozoan and diseases.
		CO3	Explain External Features, Habit and Habitat of Phylum Porifera, Structure and Significance of Canal System.
		CO4	Phylum Coelenterates, Gastrovascular Cavity, Mesenteries, Reproduction. Understand various physiological processes at molecular level of animals from different phyla.
		CO5	Phylum Platyhelminthes Digestive, Excretory,Reproductive System and Life Cycle.
		CO6	Phylum Mollusca (Shell and Body), Digestive, Respiratory, Reproductive System. Phylum Echinodermata Digestive System, Water Vascular System.
		CO7	Phylum Hemichordate ,Body Of Balanoglossus ,Affinities with Non-chordates and Chordates. Morphological and Physiological, Parasitic Adaptation in Helminthes. Larval forms and their significance. Aware students about knowledge and skill in the fundamentals and systematics of animal kingdom.
	B.Sc. SEM II Zoology	CO1	Understand various developmental biology processes at molecular level of animals. General Organization of Prokaryotic and Eukaryotic Cells. Structural Arrangement, Function of Plasma Membrane and Endoplasmic Reticulum.
		CO2	Ultra Structure and functions of Golgi Complex, Ribosome,Mitochondria,Lysosomes.
		CO3	Explain Ultra structure of Nucleus, Nucleolus. Chromosome and its General Organization.
		CO4	Detail study of cleavage, and Development up to Coelome Formation in Amphioxus.
		CO5	Cleavage ,Blastulation and Gastrulation up to the Formation of Three germ in Frog ,Fate map. Cleavage ,Blastulation and Gastrulation up to the Formation of three germ layers in Chick.

	CO6	Placentation in mammals, Types and Functions of Placenta, Parthenogenesis, Regeneration in invertebrates and vertebrates. Elementary idea of, sources types and use of Stem cells.
B.Sc. SEM III Zoology	CO1	Protochordates Amphioxus, Digestive system and feeding, Excretory organs, gonads- Affinities of Amphioxus.
	CO2	Affinities of Agnatha alimentary canal and digestive glands, Respiratory organ and mechanism of respiration, Circulatory System Structure and working of Heart, major arteries and veins, Lateral line receptors, Migration in fishes Types, causes and significance.
	CO3	Amphibia external, characters. Respiratory organs-Circulatory system; Structure of Heart, major arteries and veins, urinogenital system.. Parental care in amphibia.
	CO4	Class Reptilia- Calotes versicolor- circulatory system-Structure of Heart, major arteries and veins. Urinogenital system, snake venom and anti-venom,
	CO5	Class Aves -Respiratory system,urinogenital system. Flight adaptations, Migration in birds. Primitive mammals: salient features of Prototheria and Metatheria, Morphology of mammalian endocrine glands. Aquatic mammals.
	CO6	Describe Evolution, Direct and indirect evidences of evolution, Darwinism, Lamarkism and modern concept of organic evolution. Study of Adaptive radiations in mammals and Evolution of man.
B.Sc. SEM IV Zoology	CO1	Concept Interaction of genes. Mendel`s laws of hereditary–Monohybrid Laws of dominance, law of segregation. Dihybrid cross–Law of independent assortment . Types of linkage, linkage group, arrangement of linked genes, and significance of linkage.
	CO2	Mitotic and meiotic, Mechanism, Types ,theories, Significance, Factors affecting crossing over–Darlington's theory, breakage and exchange theory, and copy choice theory. Single, double and multiple crossing over.
	CO3	Multiple alleles. Multiple alleles in relation to eye color in Drosophila. Blood group in man, Erythroblastosis foetalis.
	CO4	Sex determination, Chromosomal Theory in animals, Autosomes and sex chromosomes, Sex determination. Genic Balance Theory. Environmentally and hormonally controlled sex determination.
	CO5	Genetic disorders , Sex linked genetic disorders and their inheritance in man. Haemophilia and color blindness.

			Ecology: concept and scope, Abiotic , Biotic factors. Ecosystem: Terrestrial, Aquatic, Fresh water .
		CO6	Genetic Screening, Gene probe and DNA analysis. Genes in Human Heredity - Inheritance of eye, Skin color. Recessive genes and consanguineous marriages Genetic counselling, Birth control measures (male and female).Kinds of twins, Significance of twins study.
	B.Sc. SEM V Zoology	CO1	Structure of Respiratory Organs: Gills ,Lungs. Transport, Exchange of Gases. Neurophysiologic Control of Respiration. Circulation: Blood-Coagulation factors, Blood Group, Rh - factor.
		CO2	Muscle Physiology: Types ,E.M. Structure, Chemical Composition. Muscle Contraction.
		CO3	Nerve Physiology: Neuron E. M. Structure and Types. Conduction of Nerve Impulse, Resting , Action Potential, Neurotransmitters, Synapse and Synaptic Transmission. Chemical Co-ordination: Endocrine System, Hormone and their Physiological Role. Hormonal Disorders.
		CO4	Reproductive Physiology : Estrous and Menstrual Cycle, hormonal control of reproduction in male and female. Structure and physiology of Mammalian Placenta. Homeostasis and Conservative regulation.
		CO5	Agricultural Zoology: Economic Importance of Insects. Beneficial Insects. Harmful Insects.
		CO6	Aquaculture: Scope, Importance and present status in India. Fresh water fish culture. Fish Products and byproducts .
	B.Sc. SEM VI Zoology	CO1	Explain Genetic Material (DNA And RNA).Experiments to prove DNA as genetic material, Types of DNA and RNA.
		CO2	DNA Replication, Concept of Genes. Genetic Diseases.
		CO3	Genetic Code, Protein Synthesis and Gene Regulation.
		CO4	Mutation : Types, Theory ,Molecular Basics of Mutation. Blotting Techniques, PCR. DNA fingerprinting.
		CO5	Biotechnology: Genetic Engineering, Recombinant DNA Technology. Gene Cloning.
		CO6	Immunology: Types, Immunological Techniques.

Course Code	Name of the Course	COs	After completing this course students must be able to
	M.Sc. SEM I Paper I ANIMAL STRUCTURE AND	CO1	Explain the basics basic concepts of biosystematics taxonomy and classification, History of Classification.

FUNCTION (NON-CHORDATA)		
	CO2	Explain Feeding and Digestion, mode of feeding. Feeding & digestion in Bryozoans and, Echinodermata, Invertebrate hormones of reproduction.
	CO3	Understand the Organs of respiration, Respiratory pigments in invertebrates, Excretory organs and excretion and General organization of Nervous system, Sense organs.
	CO4	Understand the Functional variations of reproductive structures in non-chordate and Reproductive mechanisms in Nonchordates. Sense organs.
	CO5	Explain Reproductive mechanisms in Nonchordates, Excretion, Excretory organs and excretion. General organization of Nervous system.
Paper II ANIMAL STRUCTURE AND FUNCTION (CHORDATA)	CO6	Taxonomic Character- Different kinds .Origin of reproductive isolation, Biological mechanism of genetic incompatibility. Taxonomic procedures.
	CO7	Understand International code of Zoological Nomenclature (ICZN). Biology of sex determination.
	CO8	Vertebrate integument, Endoskeleton structures, Structure of tooth and dentition in Mammalia, Structural and functional organization of degestive system in Protochordata.
	CO 9	Understands Cell specification and Differentiation, Body axis formation, Contraception, Biology of sex determination,
	CO10	Explain Reproductive mechanisms in Nonchordates. Excretion, Metanephros, Functional organization of vertebrate nervous system .Sense organs. Echolocation. Flight adaptations in mammals. Aquatic adaptations & Adaptive radiations in mammals. Migration in birds, and fishes.
Paper III GAMETE BIOLOGY	CO11	Heterogamy in eukaryotes, Leydig cells, Spermatogenesis Biochemistry of Semen.
	CO12	Ovarian follicular growth and differentiation ,Oogenesis and vitellogenesis-morphogen gradient, Ovulation and its regulation. Creating multi cellularity Genomic imprinting
	CO13	Fertilization-Cell surface molecules in sperm-egg recognition in animal . Amphimixis.
	CO14	Assisted reproduction techniques. In vitro fertilization.
Paper IV GENES AND DIFFERENTIATION	CO15	Transgenic animals, Gene Knockout technology, Gene therapies, Antigens and antisense therapy.
	CO16	Cell specification and Differentiation, Body axis formation.
	CO17	Environmental cues and effects , Contraception, Surgical , Hormonal ,Physical barriers.
	CO18	Intrauterine contraceptive devices (IUCDs).
	CO19	Biology of sex determination ,Stem cells,Biology of sex determination
	CO20	Stem cells, Stem cell disorders, Stem Cells and Diabetes, Use of Genetically Modified Stem Cells in Experimental Gene Therapies, Bone marrow transplantation.

M.Sc. I Sem I Practical	CO1	Understand Comparative anatomy of Excretion in Annelid, Insect and Molluscan models. Explain Qualitative and Quantitative estimation of Zooplankton communities. Explain Morphology and histology of non-chordate and chordate ovary and testis (Insects, snails, frog and rat).
	CO2	Explain Permanent slides stained preparations. Understanding Effect of anti-fertility drugs on biochemical estimation in various part of reproductive tract a) Ascorbic acid b) Acid/Alkaline phosphatase.
	CO3	Understand Morphogenesis, growth and study of different types of cells present in bone marrow chick, *Amphioxus,* Frog and pig development through slides and whole mounts. Explain Study of abnormal sperm count.
M.Sc. SEM II Paper V MOLECULAR CELL BIOLOGY	CO 1	Explain molecular Cell Biology, Biomembranes.
	CO 2	Extracellular matrix, Properties of Cell Surface Receptors.
	CO 3	Cell Signaling, Cell cycle control and Secretory pathways.
	CO 4	Cytoskeleton, Role of microtubules in mitosis.
	CO 5	Secretory pathways, Transport of proteins across nuclear membrane.
PAPER – VI TOOLS AND TECHNIQUES IN BIOLOGY	CO 6	Understand tools and techniques in Biology Principles and uses of: Colorimeter ,Spectrophotometer, Spectroflurometer.
	CO 7	Microscopes, Principles and application, Light, phase contrast, fluorescence, Scanning and transmission electron microscopy,Atomic Force microscopy.
	CO 8	Microbiological techniques, Organelle separation by centrifugation and Cryotechniques.
	CO 9	Molecular separation by thin layer gas chromatography & Molecular separation by high pressure liquid chromatography.
	CO10	Separation techniques in biology, Radioisotope and mass isotope techniques in biology.
PAPER VII – ENDOCRINOLOGY	CO11	Explain Endocrinology, Histology of vertebrate endocrine glands.
	CO12	Classification of Hormones (Peptides, Steroids and amino acid derived), Hormonal regulation of carbohydrate, Lipid and Protein metabolism. Hormonal regulation of Growth and Reproduction
	CO13	Synthesis, transport (release) and metabolism of steroid hormones, T3, T4 ,epinephrine and insulin.
	Co 14	Thyroid hormones and disorders, Diabetes, Comparative study of steroid and non-steroid hormones in reproduction.
	CO15	Hormone replacement therapy, Neuroendocrine mechanism in insects and crustacean metamorphosis.
PAPER VIII ENVIRONMENT AND ECOLOGY	CO16	Understand Environment and Ecology, Population ecology.
	CO17	Community ecology, Ecological succession, Ecosystem and Biogeography.
	CO18	Explain Environmental Pollution, Conservation biology,

	CO19	Toxicology, Environmental Monitoring .
	CO20	Control, monitoring & surveillance of environment.
Practical	CO1	To study the rate of oxygen consumption by aquatic animals under various Environmental stress. Biodiversity Inventories/Surveys. and Field Techniques.
	CO 2	Anatomy and Histology of various vertebrates endocrine glands and insects neuroendocrine structures. Effect of toxicants on histoarchitecture of various endocrine glands.
	CO3	To estimate total hardness of different samples of water. To estimate nitrate contents of different samples of water.
SEM III Paper IX MOLECULAR CYTOGENETICS- I	CO 1	Mutation: Basic features , Adaptation versus mutation, Phenotypic Effects of mutation. Molecular basis of gene mutation.
	CO 2	Somatic Cell Genetics , Radiation hybrid panels and gene mapping, Epigenetics.
	CO3	Genome Organization, Mobile DNA, Genetics of Cancer, Relationship of cell cycle to cancer, Tumor suppressor genes.
	CO4	Human Cytogenetic, Numerical abnormalities of human chromosomes and related syndromes, Human metabolic disorders. Structural abnormalities of human chromosomes and related syndromes.
	CO 5	Mitochondrial DNA and human diseases, Genetic Counseling, Carrier detection,. Fetal analysis (amniocentesis and chorionic villus sampling),Pedigree analysis.
Paper – X MOLECULAR CYTOGENETICS- II	CO 6	Microbial genetics, Bacteriophages, Extra chromosomal inheritance.
	CO7	Molecular Cytogenetic Techniques, DNA fingerprinting: DNA sequencing, Polymerase chain reaction (PCR), Fluorescence in situ hybridization (FISH).
	CO 8	Genome Analysis, Functional genomic. Population Genetics, Genetics of quantitative traits in populations.
	CO 9	Population Genetics, Genetics of quantitative traits in populations.
	CO10	Molecular Phylogenetic, Nucleic acid phylogeny, Protein phylogeny Mitochondrial DNA and evolution. Genetic code, Prokaryotic and eukaryotic translation
Paper-XI (Elective paper-I) Animal Physiology -I	CO11	Muscle Physiology, Ultra structure of skeletal muscle, Muscle proteins, Physical and Chemical Properties skeletal muscles.
	CO12	Ultra Structure of neuromuscular junction (motor end plate), Muscular disorders.
	CO13	Nerve Physiology, Ultra structure of neuron.
	CO14	Electrical properties of nerve, Action potential, Resting potential, Depolarization and Repolarization.
	CO15	Ultra structure of synapse, Types of neurotransmitters, Role of calcium, sodium and potassium channels.
Paper - XII Elective Paper - Animal Physiology -II	CO16	Receptor Physiology & Pathways, Mechano receptors,Photo receptors, Thermo receptors,Chemo receptors,Electro receptors, Magneto receptors ,Equilibrium receptors.
	CO17	Physiology of High altitude, Respiratory changes, Exercise at high altitude.

	CO18	Physiology of Exercise, Physiology of Excretion, Histophysiologies of excretion, Urine formation, Ultra filtration, Reabsorption, and Secretion.
	CO19	Structure and mechanism of action of Hypothermic hormones (TRH, GnRH). Role of kidney in pH regulation and water salt regulation.
	CO20	Foetal Physiology, Neonatal Physiology, Introduction to Sociophysiology, Honey and lac productions in insects Pheromones in insects and mammals, Physiology underlying fear and anxiety in animals and parental care in Primates.
Practical -	CO1	Simple muscle curve Effects of temperature and calcium, Estimation of serum creatinine, serum urea. Qualitative analysis of urea. Experiments on Blood
	CO2	Cardio dynamics; kymograph record of heart beat in site effects of Drugs on heart action, Study of estrus cycle using vaginal smear in female rat, Estimation of genomic DNA in fish, reptiles, birds and mammals.
	CO 3	Quantities estimation of calcium, phosphorus sodium and potassium, Separation and identification of amino acids by paper and thin layer, chromatography- ground and two dimensional chromatography.
Semester IV Paper - XIII Biochemistry	CO 1	Explain Biomolecules pH, pK, acids, bases, buffers, isomerization. Muscle proteins, Respiratory proteins.
	CO 2	Amino acids and Proteins Structure and chemistry of amino acids, Essential and non-essential amino acids Ornithine cycle, Protein structure , folding & Conjugated proteins
	CO 3	Nucleic Acids ,Structure of DNA, Triplex and quadruplex DNA, Structural polymorphism of DNA, Circular DNA and super coiling, Structure, types and functions of RNAs.
	CO 4	Carbohydrate metabolism, Glycolysis, regulation & energetics TCA cycle & regulation. Gluconeogenesis ,Glycogenesis & glycogenolysis .
	CO 5	Lipid Metabolism, Ketone bodies – Structure, biosynthesis and functions.
PAPER XIV ENZYMOLOGY AND BIOSTATISTICS	CO 6	Structure, Classification, nomenclature & kinetics. Kinetics of single substrate and bisubstrate enzyme catalyzed reactions, cooperativity.
	CO 7	Enzyme: Categories & Functions. Enzymes involved in energy production,Enzymes involved in biodegradation.
	CO8	Enzyme: Functional diversity & applications. Coenzymes, mechanism of action, Enzymes involved in protein synthesis Enzymes involved in free radical formation, cell signaling, nucleic acid metabolism.
	CO9	Biostatistics, Diagrammatic representation of data (Line graph, Bar diagram, Pie diagram), Standard deviation, Standard error.
	CO10	Biostatistics, chi square test as a test for goodness of fit Analysis of variance (ANOVA),correlation analysis, correlation types and methodsto study correlation, significance test of correlation coefficient Regression analysis, kinds of regression analysis (regression line, regression equations),Estimation of allele

		frequency (dominant and co-dominant cases),Examples on Hardy-Weinberg equilibrium.
Paper - XV Animal Physiology – III	CO11	Physiology Nervous System, Functional compartmentalization of brain: a) Fore brain, b) Mid brain, c) Hind brain, Reflex arc and types of reflexes.
	CO12	Physiology of learning, Mimicry, Bioelectricity, Audio signals, Echolocation Organs and physiology.
	CO13	Homeostasis Physiology Water contents and distribution. Components of Homeostatic Control system. Reflexes, Local Homeostatic Responses.
	CO14	Adaptation and Acclimatization. Biological Rhythms, Balance in the Homeostatis of chemicals. Basic thermoregulatory mechanism in poikilotherms and Endotherms.
	CO15	Patterns of Nitrogen excretion among different animal Groups. Liver is important in the storage and Homeostasis of Iron. Factors destabilizing homeostasis mechanism fever, Diabetes mellitus and diarrhea. Homeostatic mechanism of minerals.
Paper - XVI Animal Physiology - IV	CO16	Digestion, Absorption, Utilization of Protein,Carbohydrate and Lipid.Histophysiologies of gastric gland, Secretory Functions of the Alimentary Tract.Gastrointestinal Function
	CO17	Physiology of Respiration Anatomical and physiological organization of respiratory system. Mechanism of respiration breathing movements and the exchange of respiration, Respiratory gases at pulmonary surface. Transport of gases by blood. Oxygen dissociation curve, Co2 dissociation curve
	CO18	Physiology of Circulation Anaemia and polycythemia, platelets and Blood substitute. Regulation of heart beat and blood pressure Role in oxygen transport,their physiological significance, Transport of CO2. Origin and conduction of cardiac impulse .
	CO19	Anatomy and histology of mammalian heart .Structure & function of Myogenic and neurogenic heart .Cardiac out put Cardiac cycle, sound Pace Maker system .
	CO20	Blood pressure and its regulation, Factors that affects blood pressures. Electro cardiograph, and interpretations of ECG. Lymph- composition, Formation Functions of lymph ,Structure and functions of lymph node
Animal Physiology - IV Practical	CO1	Properties of saliva. Isolation and identification of rumen microorganisms. Estimation of rumen ammonia and blood urea under various physiological conditions. Normal and abnormal constituents of urine.
	CO2	Microscopic examination of urine. Prepararion and examination of blood smear to study blood cells. Differential leucocytes count.
	CO3	Histochemical demonstration of Carbohydrates,Proteins,Lipids Nucleic acids, Acid and alkaline phosphatase. Qualitative analysis of urea, ketone bodies and salts.