B.Sc. Biotechnology (Hons.)

Program Outcomes

After successful completion of B.Sc. Biotechnology (Hons.) Programme student will

PO1: Understand and integrate theoretical and practical skills in basic and applied disciplines of Biotechnology.

PO2: Demonstrate comprehensive knowledge and understanding of one or more disciplines such as Physics, Chemistry, Molecular Biology, Cell Biology, Biochemistry etc. that form a part of an undergraduate programme of study.

PO3: Proficient enough to take employment in diverse areas of Biotechnology as well as for further higher studies.

PO4: Become Competent Biotechnologist's who can employ and implement their knowledge base in processes and applications which will profoundly influence or utilized for existing paradigm of agriculture, industry, healthcare and restoration of degraded environment to provide sustainable competitive edge to present society. Students will be eligible for doing jobs in various sectors of pharmaceutical and biotechnological industry.

PO5: Learn to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. B.Sc. students undergo training in a research institute lab, which helps in developing scientific temper among them.

PO6: Develop Research-related skills. A sense of inquiry and capability for asking relevant and appropriate questions, Ability to define problems. formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses and report the results of an experiment or investigation.

PO7: Moral and ethical awareness/reasoning: While compiling summer training report file students are encouraged to avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism. Environment education and other related activities help them in appreciating environmental and sustainability issues.

PO8: Work independently, identify appropriate resources required for a project and manage a project though to completion training program/practical's done by the graduate program helps them in self-directed learning

PO9: Able to work effectively and respectfully with diverse teams; and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO10: Use ICT in a variety of learning situations. demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO11. Learn to express thoughts and ideas effectively in writing and orally and develop ability to present complex information in a clear and concise manner.

Program Specific Outcome

Graduates in B.Sc. Biotechnology (Hons.) will be

PSO1: Eligible for pursuing higher education, M.Sc. programmes in the different field of life science.

PSO2: Exhibit contemporary knowledge in Biotechnology and students will be eligible for doing jobs in Pharmaceutical and Biotechnological Industry.

PSO3: Able to understand the potentials, and impact of biotechnological innovations on environment and their implementation for finding sustainable solution to issues pertaining to environment, health sector, agriculture, etc.

PSO4: Proficient to design, conduct experiments, analyze and interpret data for investigating problems in BT and allied fields.

PSO5: Develop ability to work individually as well as in team to survive in multidisciplinary environment.

PSO6: Acquire oral and written communication skills

B.Sc. (Hon's) Biotechnology Semester 1

Mathematics- A BIOT-Sem-I TA/TB

Course Outcome

CO1: Demonstrate and justify standard and alternative algorithms for addition, subtraction, multiplication and division of whole numbers, integers, fractions, and decimals.

CO2: Formulate problems in the language of sets and perform set operations, and will be able apply the Fundamental Principle of Counting.

CO3: Engage in analyzing, solving, and computing real-world applications of finite and discrete mathematics, set up and solve linear systems/linear inequalities graphically.

CO4: Solve problems for limits, derivatives, and definite & indefinite integrals of algebraic, logarithmic and exponential functions.

Practical

CO1: Identify, explain, and evaluate the use of elementary classroom manipulative to model sets, operations, and algorithms.

CO2: Analyze functions and their graphs as informed by limits and derivatives and

CO3: Translate a real world problem, given in words, into a mathematical formulation.

Life Sciences BIOT-103B-T

Course outcome:

After successfully completing the course, students will be able to:-

CO1: Learn about the introduction to life on earth and concepts of life science, comprising the anatomy and physiology of plants and animals

CO2: Understand the concepts of nutrition and transport phenomena in plants, an introduction to plant reproduction.

CO3: Study about the ecology and ecosystems including the definition and components such as food chain, food web and habitat.

CO4: Learn about the ecology related to community interactions with suitable examples

CO5: Describe the concepts related to ecological succession and types of succession.

CO6: Learn about the structure and working mechanism of all systems present in the body such as digestive system, circulatory system, respiratory system, reproductive system etc.

CO7: Clears the concepts related to structure and function of various endocrine glands with the hormones released by them

CO8: Understand the basics of immune system and immune response in animals: B cells and T cells

Practical outcome: - BIOT-103B-P

CO1: Learn the use of microscope and preparation of slides to study the various cell of organisms cell

CO2: Describe about the digestive, Respiratory, Circulatory, Endocrine and Reproductive system of Human body through various oral and poster presentations

CO3: Study about the slides/specimens and identification –Bacteria, Oscillatoria, Spirogyra, Rhizopus, Mushroom, Yeast, Liverwort, Moss, Fern, Lichen, One Monocotyledon and dicotyledon.

CO4: Learn about the characteristics of amoeba, hydra, tapeworm, roundworm, earthworm, cockroach, pila, starfish, shark labeo, frog, lizard, pigeon and rabbit

Introduction to Biotechnology BIOT-Sem-I-VI-T

After successfully completing this course, students will be able to:

CO1. Explain advancement, scope and basics of biotechnology.

CO2. Explain about the use of Bacteria as workhorses of biotechnology.

CO3. Describe Model organisms such as E. coli, Saccharomyces cerevisae and Neurospora as well as about multicellular organisms as research models (Drosophila melanogaster etc.).

CO4. Explain role of Viruses and Bacteriophages in Biotechnology.

CO5. Demonstrate the structure and function of the cell, Prokaryotic and Eukaryotic cells, Biomolecules in a cell such as DNA, RNA, and Proteins. Describe the concept of genomics, proteomics, transcriptomics and metabolomics.

CO6. Acquire basic techniques like sterilization, centrifugation, electrophoresis, chromatography and sonication.

CO7. Understand fundamentals of recombinant DNA technology, Restriction enzymes, Type II Restriction endonucleases and describe vectors based on E. coli plasmids and their properties like pBR322, pBR327, pUC8.

CO8. Explain Applications of biotechnology (today and tomorrow), Basics of biotechnology in fermentation processes, Green technology to control pollution, Role of biotechnology in diagnostics and introduction to gene therapy.

CO9. Describe genetically modified organisms (GMOs) - transgenic plants and animals and their applications in biotechnology as well as public concerns and risks associated with genetic engineering.

Course: Practical's in Introduction to Biotechnology

CO1. Use of basic equipment's in a biotechnology laboratory (Auto -pipettes, pH meter, centrifuges, light microscope etc.).

CO2. Handle and dispose hazardous reagents (acids, carcinogenic chemicals like acryl amide, ethidium bromide) and concept of chemical hoods.

CO3. Learn Good laboratory practices followed in biotechnology laboratory.

CO4. Describe the procedure of Cell disruption and cell lysis of animal/ plant/ bacterial cell.

CO5. Describe various sterilization techniques.

CO6. Learn about bioinformatics tools used in biotechnology

B.Sc. (Hon's) Biotechnology Semester Ⅱ

Statistics & Computer Fundamentals BIOT-Sem-II-III-T

Course Outcome

CO1: Organize, present and interpret data, both numerically and graphically.

CO2: Classify variables as quantitative or categorical, create appropriate numerical and graphical summaries for each type and use these to explain/identify relationships between variables.

CO3: Solve basic problems in probability theory, including problems involving the binomial, Poisson and normal distributions.

CO4: Estimate basic population parameters and perform a basic hypothesis testing.

CO5: Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.

CO6: Explain the working of important application software and their use to perform any Biological activity.

CO7: Demonstrate the use of algorithms and flowcharts to plan the solution of a computing problem.

Practical:

CO1: Discussion about test the efficiency of a new drug or medicine which used in clinical investigation.

CO2: To provide orientation of statistics while designing statistical experiments, particularly in agricultural set up and in pharmaceutical production processes.

CO3: Analyze compression techniques and file formats to determine effective ways of securing, managing, and transferring data.

CO4: Learn the basics of e-mail, such as sending, forwarding and receiving mail, attaching documents, creating mailboxes, filters, and address books.

Basic biochemistry

Course outcome BIOT-204-T

After successfully completing the course, students will be able to:-

CO1: Know about the importance of biological macromolecules

CO2: Learn about the biochemical aspect of cell, chemical structure & function of various biomolecules.

CO3: To study the influence and role of structure in reactivity of bio-molecules

CO4: Learn about the physicochemical properties of water, dissociation and association constants, pH and buffers, pI, pka,

CO5: Learn about the classification and general functions of carbohydrates, lipids, vitamins, nucleic acid, proteins

CO6: Familiar about the biochemical activities taking place taking place at cellular level, highlighting the enzymatic reactions.

Practical outcome Course No: BIOT-204-P

CO1: Acquire knowledge about the quantitative and qualitative estimation of bio-molecules

CO2: Determine the pH, pKa values of various molecules

CO3: Prepare and study about the working of physiological buffers

CO4: Determine the acid value and saponifaction value of a fat.

CO5: Learn about the methods of estimation process of different bio-molecules such carbohydrates, lipids, protein etc.

Cell Biology

BIOT-Sem-II-V-T

After successfully completing this course, students will be able to:

CO1. Define the Cell theory. Explain classification and ultrastructure of cell types, tissue, organ and organism at different level of organization of genetically similar cells.

CO2. Explain ultrastructure and function of cell membrane and its organelles (golgi bodies, vacuoles, endoplasmic reticulum, etc.).

CO3. Explicate Cellular Transport mechanisms, proton pumps, and transport into prokaryotic cells, endocytosis and exocytosis, entry of viruses and toxins into cells.

CO4. Explain the process of Cell locomotion and types of cell locomotion.

CO5. Describe Chromosomes; their discovery, morphology, chemical composition, structural organization etc. and banding patterns in human chromosomes.

CO6. Learn Stem Cell technology.

Course: Practicals in Cell biology

After successfully completing this course, students will be able to:

CO1. Describe the parts and functions of light microscope.

CO2. Prepare a wet mount of onion peel slide for microscopy.

CO3. Able to Count cells using haemocytometer.

CO4. Perform subcellular fractionation of spinach cells.

CO5. Describe cell locomotion in amoeba and flagellar motility in bacteria by hanging drop technique.

CO6. Describe cell transport in cell membrane.

CO7. Perform Quantitative analysis of cell membrane lipids by TLC.

Course: BIOT-206-T: General Microbiology

After successfully completing this course, students will be able to:

CO1. Learn the basic techniques of microbiology for viewing the microbial cells, structure and growth of microbes, sterilization techniques

CO2. Study microbial pathogens, microbial interactions and immune response against pathogenic microbes.

CO3. Explain the life history and significant contributions of various scientists such as Leewenhook, Pasteur, Lister etc. in the field of microbiology.

CO4. Able to explain Principle, working, ray diagram, applications and specimen preparation techniques used for various types of microscopes such as light microscope, phase contrast microscope, electron microscope etc.

CO5. Understand the different methods and criteria used for classification of bacteria, a brief detail about Bergey's Manual and salient features of various classes into which kingdom fungi is divided.

CO6. Describe the cell structure and function of different organelles of fungus and bacteria. The structure of viruses and bacteriophages.

CO7. Develop the concept of microbial growth kinetics along with phases of growth, differences between batch culture and continuous culture, various methods used for synchronous growth such as Helmstetter cumming technique etc.

CO8. Define the various terms such as sterilization, antiseptics, disinfectants, sanitizers etc. Different methods used for sterilization.

CO9. Explain the characteristic features of normal flora microbes of humans, mechanism of colonization by them of various sites such as mouth, gastrointestinal tract etc. Names of pathogenic bacteria, fungi, viruses and protozoa along with the routes of infection, symptoms and diseases caused by them.

CO10. Describe the types of symbiosis and antibiosis with examples such as microbe-microbe, microbe-animal, microbe-plant interactions.

CO11. Brief overview of innate and adaptive immuneresponses against pathogenic microbes along with an overview of organs and cells of immune system. Describe the structure and types of antibodies and antigens.

Course: BIOT-206-P: Practical in General Microbiology

After successfully completing this course, students will be able to:

CO1. Prepare the liquid and solid culture media for the growth of microbes in clean and autoclaved glasswares

CO2. Isolate the bacteria and fungus from various samples such as air, water and soil; learn the techniques for water and soil sample.

CO3. Learn to prepare the serial dilutions, spread plate technique and pour plate technique to obtain the colonies of microbes; streak plate technique to obtain pure cultures; determination of cfu value.

CO4. Learn the Gram staining technique to distinguish the gram positive and gram negative bacteria, learn the staining of endospores of bacteria by using malachite green staining.

CO5. Prepare the growth curve of bacteria for depicting the lag, log, stationary and decline phases of growth by using spectrophotometer.

CO6. Perform the antibiotic sensitivity assay by using various antibiotic discs by measuring the zone of inhibition.

CO7. Test the physical parameters such as temp, TDS, etc.; chemical parameters such as COD and BOD; and biological parameters as the indications of quality of water sample.

B.Sc. 2nd year ('3nd semester) Biotechnology (hons)

Course: BIOT-Sem III-I-T: Biochemistry

After successfully completing this course, students will be able to:

CO1. Define metabolic pathways, anabolism and catabolism; learn mechanism of biochemical reaction, energy rich metabolites such as ATP, NAD, NADH, NADPH, etc., reason for high phosphoryl group potential of ATP, regulatory mechanisms for metabolic pathways and various hypothesis for evolution of metabolic pathways.

CO2. Understand anabolism and catabolism of carbohydrates, glycolytic pathway and the role of various enzymes in this pathway along with its regulation, gluconeogenesis and the role of various enzymes in this pathway along with its regulation, feeder pathway.

CO3. Have in depth knowledge of Kreb cycle and its enzymes, its amphibolic nature and its regulation. Learn the metabolic pathway of glycogen, role of various enzymes involved in this pathway and its regulation.

CO4. Explain the mitochondrial electron transport chain, role of complex I, II, III and IV in cellular respiration, oxidative phosphorylation, structure and function of ATP synthase and regulation of ATP synthesis.

CO5. Learn the metabolic pathways of fatty acids, such as β- oxidation of saturated, unsaturated and polyunsaturated fatty acids, role of various enzymes involved in these pathways and their regulation. Define ketone bodies and give their examples, pathway for their biosynthesis along with their physiological significance.

CO6. Understand the pathway for fatty acid biosynthesis, role of multienzyme complexes such as fatty acid synthase, role of citrate and regulation of this pathway.

CO7. Learn the biosynthetic pathway of cholesterol along with its regulation.

CO8. Explain the biosynthesis of non-essential amino acids, catabolic pathways of carbon skeleton of amino acids, amino acids as precursors of specialized products such as porphyrins, biogenic amines etc.

CO9. Understand the pathways for anabolism and catabolism of purines and pyrimidine, de novo and salvage pathways and urea cycle.

Course: BIOT-Sem-III-I-P: Practical in Biochemistry
After successfully completing this course, students will be able to:

CO1. Estimate the quantity of DNA by diphenylamine reagent by plotting the standard curve using spectrophotometer.

CO2. Perform the 3,5 dinitrosalicyclic acid method spectrophotometrically and Benedict's test for determination of reducing sugars.

CO3. Calculate the iodine number of fat for checking the extent of unsaturation in fatty acids.

CO4. Determine the extinction coefficient of nucleic acids by using spectrophotometer.

CO5. Perform the Biuret assay to determine the unknown concentration of protein by plotting the standard curve.

CO6. Perform the quantitative estimation of amino acids using ninhydrin reaction.

CO7. Estimate the concentration of RNA by orcinol method by plotting the standard curve.

Immunology-I BIOT-Sem-III-III-T

CO1. Learn the concept of immunology, immunity, immune-response and immunogenicity

CO2. Discuss about the overview and types of immunity. Components and salient features of different types of immunity

CO3. Describe immune cells and how immune cells get activate and proliferate in response to stimulus or antigen and also Lymphocyte Trafficking, cell surface proteins, cell adhesion molecules

CO4. Define, characteristics, types and function of antigen and antibody molecules. The different mechanisms by which antigen (both endo and exogenous) are processed and presented and also understand the concept of MHC complex

CO5. Develop concept of Production of Monoclonal Antibodies by Hybridoma technology, applications of polyclonal and monoclonal antibodies.

CO6. Different antigen-antibody interaction mechanisms- precipitation, agglutination, ELISA etc.

Practical Immunology BIOT-Sem-III-III-P

CO 1. To learn about the Lymphoid organs and their microscopic organization.

CO 2. Understand about the Differential leucocytes count.

CO 3. Understand about Separation of serum from blood.

CO 4. Understand the process of Separation of plasma from blood.

CO 5. Perform the Ouchterlony Double Diffusion

CO 6. Learn and describe about Radial immuno diffusion test using specific antibody and antigen.

CO 7. Perform the Agglutination (Blood group testing).

Genetics BIOT-Sem-III-II-T

After successfully completing the course, students will be able to:-

CO1. Learn about the science of heredity with emphasis on the basics of Mendelian and molecular genetics

CO2. Learn about concepts of chromosome organization, linkage, chromosome mapping, chromosome aberrations, mutations and microbial genetics.

CO3. Describe the concepts of population, evolutionary and quantitative genetics including: the basis and estimation of genetic variation; Hardy-Weinberg Equilibrium; genetic drift; effective population size

CO4. Develop the critical thinking and analytical skills necessary to assign a transmission pattern from a human pedigree and to calculate probabilities related to human pedigrees, genotypes, and phenotypes.

CO5. Develop student understand about sex-linked inheritance, sex chromosomes, sex determination and development, and sex chromosomal abnormalities, sex-influenced, and sex-limited traits

CO6. Learn about the concepts of mutation: spontaneous versus induced mutations, types of mutations, mutagenic agents: physical, chemical and radiation, molecular basis of mutations, mechanisms of DNA repair, mutations frequency

CO7. Learn about the microbial genetics including conjugation, transduction, transformation, isolation of auxotroph, replica plating techniques, analysis of mutations in biochemical pathway, one gene – one enzyme hypothesis

Practical Outcome

CO1. Describe the various stages of mitosis and meiosis and different types of chromosomes

CO2. Learn demonstration and numerical assessment of law of segregation and independent assortment

CO3. Study the use of chi-square for prediction of phenotype/genotype frequencies of parents from progeny and vice-versa, epistasis

CO4. Calculate the gene frequencies and random mating and analyze the population genetics

CO5. Learn about Dermato-graphics: Palm print taking and fingertip patterns

Plant Tissue Culture

COURSE: BIOT-Sem-III-IV-T

CO1. Learn the basics of Plant Tissue Culture including media composition, sterilization techniques and concept of cellular totipotency and differentiation in plants.

CO2. Discuss about the techniques of micropropagation, somatic embryogenesis, somaclonal variation, protoplast and somatic hybridization, cell line selection for resistance to disease, stress and herbicide.

CO3. Describe in detail about haploid and triploid production and their application in plants, production of synthetic seeds and pathogen-free plants and role of tissue culture for rapid clonal propagation in plants.

CO4. Explanation of the concept of cryopreservation of germplasm: *In situ* and *Ex situ* conservation of plants

CO5. Define secondary metabolites, their production from cultured cells and their industrial applications.

COURSE: BIOT-Sem-III-IV-P Plant Tissue Culture

After successfully completing this course, students will be able to:

CO1. Demonstrate laboratory design / set up for a plant tissue culture laboratory

CO2. Learn regarding cleaning of glass/plastic ware.

CO3. Preparation of complex nutrient medium (Murashige and Skoog's medium).

CO4. To select, prune, sterilize and prepare an explant for culture.

CO5. To culture different explants for raising callus cultures.

CO6. Significance of growth hormones in culture medium.

CO7. Demonstrate various steps of micropropagation.

Animal Cell Culture

Course: BIOT-Sem-III-V-T:

After successfully completing this course, students will be able to:

CO1. Learn the basics of animal cell culture, its history, natural surroundings of animal cells, various equipment and instruments used in animal cell culture lab, role of various components of animal cell culture, primary and secondary culture, cell lines, mechanism of differentiation and growth kinetics of animal cells, viability and cytotoxicity assays, methods for production of monoclonal antibodies and ethical concerns.

CO2. Explain the history of animal cell culture, proteins such as intergrins, cadherins etc., involved in cell-cell adhesion and cell-extracellular matrix interactions. Describe various metabolic capabilities of animal cells.

CO3. Understand the mechanism of proliferation, division, differentiation and cell signaling. Graphically explain the evolution of cell lines. Design and functions of various equipments used in animal cell culture such as LAF, inverted microscope, CO_2 incubator, etc.

CO4. Define and understand the role of various components of balanced salt solutions with examples. Role of various chemicals, various physical parameters such as temp, pH, etc. Also to discuss the role of 5% CO_2 for culturing the animal cells. Merits and demerits of adding serum to the culture media, specific uses of protein free media.

CO5. Define and develop the concept of primary and secondary culture, cell disaggregation using enzymatic methods such as trypsin, collagenase etc., and mechanical methods. Differentiate between cold and warm trypsinization, between anchorage and non-anchorage dependent cells with examples. Methods for production of transformed cells.

CO6. Explain the major characteristics and origin of commonly used cell lines with examples. Growth kinetics of animal cells, along with growth curve. Also to describe the various methods of measurement of growth of animal cells for e.g. by using hemocytometers, viability assays such as dye uptake and dye exclusion assay etc., and cytotoxicity assays for testing the toxic effects of drugs on animal cells.

CO7. Explain various methods for characterization and authentication of cells lines. Cell fusion using human cell and mouse cell, production of monoclonal antibodies, HAT selection medium, principle and various methods of cryopreservation of animal cells, biosafety practices and ethical concerns related with animal cell culture.

Course: Course: BIOT-Sem-III-V-T: Practicals in Animal Cell Culture

After successfully completing this course, students will be able to:

CO1. Perform the fumigation of animal cell culture lab using formaldehyde

CO2. Learn various aseptic and sterilization techniques used in animal cell culturing.

CO3. Prepare and have in depth knowledge of composition of minimal essential medium for animal cell culturing.

CO4. Perform the method for isolation of lymphocytes for call culturing.

B.Sc. (Hon's) Biotechnology Semester IV

Immunology-II; BIOT-Sem-IV-I-T

CO1. Students will be able to understand T-Cell Receptors and Signals, its Maturation, Activation, and Differentiation, Transplantation immunology, Vaccines and Vaccination etc.

CO2. Learn about the B Cell Activation, Differentiation: B-Cell Activation and Proliferation, In Vivo Sites for Induction of Humoral Responses, T-dependent and T-independent antigens.

CO3 Understand about the Complement system: Function, Components- Classic, Alternative, Mannose binding proteins, activation, Regulation of the Complement System, Biological Consequences of Complement Activation

CO4. Learn about the Hypersensitivity: Type I, Type II, Type III and Type IV Hypersensitivity reactions and their implications

CO5. Understand about Hypersensitivity: Type I, Type II, Type III and Type IV Hypersensitivity reactions and their implications

CO6. Learn about the Transplantation immunology- Immunologic Basis of Graft Rejection, Clinical Manifestations of Graft Rejection, General Immunosuppressive Therapy, Specific Immunosuppressive Therapy, Immune Tolerance to Allograft, Clinical Transplantation

CO7. Learn about Vaccines and Vaccination – principles of vaccination, passive & active immunization, immunization programs, adjuvants, bacterial vaccines, viral vaccines, polysaccharide vaccines, DNA vaccines, recombinant vaccines, vaccines to other infectious agents, tumor vaccines.

Practical Outcome Immunology

CO1. Perform enzyme linked immunosorbent assay (ELISA).

CO2. Demonstrate Rocket immuno-electrophoresis for antigen antibody interaction.

CO3. Isolate mononuclear cells from peripheral blood and viability test by dye exclusion methods.

CO4. Perform Total leucocyte count (TLC).

CO5. Isolate IgG from serum.

Course: BIOT-Sem-IV-II-T: Biophysical and Biochemical Techniques

After successfully completing this course, students will be able to:

CO1 Learn the principle, instrumentation and applications of several biophysical and bioanalytical techniques and tools used in biotechnology.

CO2. Understand the basic principle, instruments, block diagram and major applications of spectroscopic techniques. Define Beer Lambert law, describe various light sources, monochromator and detectors used for UV/Vis, fluorescence, IR spectroscopic techniques etc. Differentiate between IR and Raman spectroscopy and between CD and ORD spectra. Principle behind NMR and ESR and elucidation of structure of biomolecules using them. Principle of MRI.

CO3. Define Electrophoresis and describe the principle behind it along with factors affecting it. Electrophoresis of nucleic acids such as principle, working and applications of agarose gel electrophoresis, PFGE etc. Electrophoresis of proteins such as principle, working and applications of SDS-PAGE, isoelectric focusing, 2D PAGE etc. Role of various components of loading buffer and methods of detection of bands on gel.

CO4. Explain the principle, ray diagram and applications of light microscopy, phase contrast microscopes etc. Define mathematically the resolving power and magnification of a microscope. Differentiate between light microscope and electron microscope and between SEM and TEM.

CO5. Define centrifugation and explain the theory of centrifugation, equation for sedimentation rate, sedimentation coefficient, relation between RPM and RCF. Types and applications of preparative centrifugation such as differential, rate zonal and isopycnic centrifugation and types of analytical centrifugation such as sedimentation velocity and sedimentation equilibrium. Types of centrifuges and rotors.

CO6. Develop the concept about crystallography, several methods of crystal formation and mounting of crystals. Define mathematically the Bragg's law, several methods of X-ray diffraction such as rotating crystal method, powder method etc. along with their applications.

CO7. Define, types and basic principles of chromatography such as TLC, gel filtration, affinity, ion exchange chromatography etc. Principle, instrumentation such as types of pumps, columns, detectors etc. used for HPLC along with advantages of HPLC over conventional chromatographic techniques. Principle, instrumentation with major emphasis on types of detectors, columns and uses of gas chromatography.

CO8. Explain various types and applications of radiotracers. Methods for counting and detecting radioactive radiations using proportional, GM and scintillation counter along with their principle, construction and applications. Relation between applied voltage and count rate, quenching of GM and scintillation counters. Mechanism and applications of autoradiography and types of isotopes used for it.

CO9. Understand the principle, instrumentation and applications of MS, ionization modes such as ESI, EI, MALDI etc., types of mass analyzers such as Quadrupole, TOF etc., and detectors. Principle and working of tandem MS. Principle and applications of GCMS and LCMS along with types of columns and ionization modes specifically used for them.

Course: BIOT-Sem-IV-II-P: Practicals in Biophysical and Biochemical Techniques

After successfully completing this course, students will be able to:

CO1. Identify the given unknown sample by using spectroscopic techniques such as colorimetry by estimating the λ_{max} from absorption spectrum.

CO2. Perform the quantitative estimation of given biological sample such as DNA or protein by plotting the standard curve by using UV/Vis spectrophotometer.

CO3. Learn the various parts, uses and care of a light microscope; cleaning of lenses of light microscope.

CO4. Demonstrate the principle, construction and working of various equipment such as GM counter, proportional counter and scintillation counter used for counting and detecting the radioactive radiations, learns the procedure followed for the process of autoradiography.

CO5. Perform the gel filtration chromatography of proteins to separate the proteins according to their size.

Plant Biotechnology (BIOT-Sem-IV-III-T)

After successfully completing this course, students will be able to:

CO1. Explain different aspects of plant molecular biotechnology and techniques for plant genetic manipulations

CO2. Describe genetic material of plant cells including chloroplast and mitochondrial DNA.

CO3. Describe modes of gene delivery in plants: Direct and Indirect methods. Explain screening and selection of transformants.

CO4. Define Transgenic plants, method for genetic modification of plants and its applications.

CO5. Describe applications of plants cell as factories for production of various industrially important compounds.

Course: Practicals in Plant Biotechnology.

After successfully completing this course, students will be able to:

CO1. Perform Aseptic culture techniques for establishment and maintenance of cultures.

CO2. Prepare stock solutions of MS basal medium and plant growth regulators.

CO3. Perform micropropogation of Tobacco plant by leaf disc culture.

CO4. Isolate plant genomic DNA by modified CTAB method.

CO5. Perform Agarose Gel Electrophoresis.

CO6. Perform Agrobacterium mediated plant transformation.

Course: BIOT-Sem-IV-IV-T: Animal Biotechnology

After successfully completing this course, students will be able to:

CO1. Learn the basic concept of organotypic, histiotypic culture, and fundamentals of tissue engineering, steps involved in IVF and embryo transfer, role of animal cell culture for production of vaccine, hormone, etc., scaling up of animal cell culture and production and applications of transgenic animal.

CO2. Define and explain the techniques of organotypic and histotypic cultures along with their advantages andapplications.

CO3. Understand the steps of and principle behind three dimensional culture and tissue engineering, various components of tissue engineering such as stem cells, scaffold and growth factors, biomaterials, concept of biocompatibility, describe cell-scaffold interactions and various techniques used for imaging the cells in 3D construct such as confocal microscopy etc.

CO4. Explain and define *in vitro* fertilization (IVF) along with procedure followed for IVF, success rate, complications and side effects, role of hormones in IVF, current status of IVF in India and world and its future. Describe the steps in embryo transfer technology for animals.

CO5. Describe the role of animal cell culture in vaccine development such as viral vaccines for rabies, polio, influenza etc., and recombinant protein vaccines, vaccine production plant and its purification, steps for vaccine production through animal cell culture, develop a concept about cells as protein factories for production of influenza virus vaccine based on Baculovirus-insect cell expression etc., steps involved in production of personalized vaccines such as against cancer and dendritic cell based cancer vaccines.

CO6. Explain the scaling up of suspension culture such as stirred and static suspension culture, along with factors affecting scale up such as chemical and physical parameters, scale up in

monolayer culture using roller bottles, micro-carrier culture etc., and how to monitor the cell growth during the scale up of monolayer and suspension culture.

CO7. Understand the concept of transgenesis, methods of gene transfer such as DNA microinjection, embryonic stem cell transfer, nuclear transfer method etc., selection of clone containing DNA insert by using insertional inactivation etc., major applications of transgenic animals such as for food, enhanced milk production, carcass composition, recombinant protein production such as insulin, alpha-1-antitrypsin protein, silk etc., xenotransplantation etc. Biosafety and ethical issues related with transgenic animals.

CO8 Describe the methods for production of various products of human use with health benefits such as antibiotics, growth factors for e.g. EGF, FGF etc., and various hormones such as insulin, somatostatin etc. by culturing animal cell

Course: BIOT-Sem-IV-IV-T: Practicals in Animal Biotechnology

After successfully completing this course, students will be able to:

CO1. Learn the growing the cell monolayers *in vitro.*

CO2. Perform warm and cold trypsinization of monolayers and learn to count the animal cells using hemocytometer.

CO3. Perform the viability assay using trypan blue dye to distinguish living and dead animal cells.

CO4. Perform the MTT cytotoxicity assay to check cytotoxicity of various compounds on animal cells grown in culture.

COURSE: BIOT-Sem-IV-V-T Agro & Industrial Biotechnology

At the end of the course, students will be able to:

CO1. Explain the steps involved in the production of bio products and methods to improve modern biotechnology and can apply basic biotechnological principles, methods and models to solve biotechnological tasks.

CO2. Learn to identify and debate the ethical, legal, professional, and social issues in the field of biotechnology and design and deliver useful modern biotechnology products to the Society. Applications of fundamental concepts like transgenic approaches to improve crop plants, microbial culture maintenance, and metabolite purification at industrial level will also be imparted to them.

CO3. Understand the practical uses of microorganisms in relevant areas of commercial application, assess the applications for cultivating cells in laboratory and industrial situations, evaluate the use of microorganisms in environmental clean-up, the food and beverage industries, biological control in horticulture and agriculture, industrial biochemical production, the use of biotechnologies for improving sustainability of energy and chemical resources

COURSE: BIOT-Sem-IV-V-P Agro & Industrial Biotechnology

The students will attain practical knowledge of:

CO 1. Counting of Microbial cells by serial dilution techniques (Spread plate and pour plate).

CO 2. Measurement of bacterial size.

CO 3. Screening of industrial enzymes (cellulase, protease, amylase etc.) from different soil samples.

CO4. Production of enzymes by submerged and solid state fermentation.

B.Sc. (Hons.) 3rd year (5th Semester)

Molecular Biology (BIOT-Sem-V-I-T)

At the end of the course, students will be able to:

CO1. Learn the chemical structure of DNA, different types of DNA, Genomic organization in prokaryotes and eukaryotes.

CO2. Differentiate between prokaryotic and eukaryotic DNA Replication.

CO3. Describe in detail about central dogma of life. Explain transcription process in prokaryotes and eukaryotes. Characterize Genetic code

CO4. Understand translational process in prokaryotes.

CO5. Explain the concept of gene regulation by defining Operon model.

Practical Outcome

CO1. Learn to Prepare f Reagents for DNA isolation.

CO2. Perform DNA isolation from plants and genomic DNA from bacteria

CO3. Perform Agarose gel electrophoresis of DNA.

CO4. Perform Plasmid DNA isolation.

CO 5. Perform Restriction digestion of DNA.

Environmental Biotechnology BIOT-Sem-V-II-T

At the end of the course, students will be able to:

CO1. Define Environment and its components, air, water, soil and noise pollution, renewable and non-renewable resources, conventional and modern fuels and their environmental impacts.

CO2. Discuss types, sources and effects of air pollution, control and impact of noise pollution, physicochemical and bacteriological analysis of soil.

CO3. Discuss wastewater treatment processes and strategies for wastewater treatment of various industrial effluents.

CO4. Define Xenobiotics, degradative plasmids and bioremediation. Have understanding of microbial degradation of substituted hydrocarbons, dyes, surfactants and pesticides.

CO5. Explain the concept of Biopesticides and Integrated Pest Management, Bioindicators, Biosorption and Bioleaching.

Practical Outcome

CO1. Detect the coli forms for determination of the purity of potable water.

CO2. Perform determination of chlorine in water and total alkalinity of water

CO3. Determine the dissolved oxygen concentration of water sample.

CO4. Learn and perform the Determination of biological oxygen demand (BOD) and chemical oxygen demand (COD) of sewage sample.

CO5. Isolate the phosphate solubilizing microorganisms from soil.

Course BIOT-Semester-V-III-T BIOINFORMATICS

At the end of the course, students will be able to:

CO1. Understand concepts of Bioinformatics and its significance in Biological data analysis.

CO2. Attain deep knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics. With the help of freely available existing software/Tools/ Databases this makes them easy in understanding and to extract, process the necessary information in reference to humans/animals and plants as well.

CO3. Explain Biological data & databases (Protein/DNA), their classification, introduction to the basics of sequence alignment (Pairwise Alignment/MSA) and analysis, biological macromolecular structures and structure prediction methods.

CO4. Illustrate the various methods, algorithms used for Phylogenetic Analysis, Tree construction.

CO5. Discuss the structure prediction programs along with Structure visualization tool –RasMol.

Practical Outcome

CO1. Search literatures over PubMed.

CO2. Perform DOTPLOT on web.

CO3. Retrieve the amino acid and nucleotide sequence from sequence databases using Entrez.

CO4. Perform BLASTp/n and interpreting its results.

CO5. Perform PSI-BLAST. 6. Performing multiple sequence alignment using Clustalw.

CO7. Find ORF in nucleotide sequence using NCBI ORF FINDER

CO8. Learn GenScan to identify exons in nucleotide sequence.

CO9. Download protein structure form PDB and visualize it using RasMol.

COURSE: BIOT- Sem-V-IV-T Enzymology

At the end of the course, students will be able to:

CO1. Explain the world of enzymes, their structure and mode of action at various cellular metabolism and their applications in Biotechnology.

CO2. Describe knowledge about the relationship between properties and structure of the enzymes, their mechanism of action and kinetics of enzymatic reactions. To characterize the enzymes in each enzymatic class, examples of such enzymes and their application in practice.

CO3 Understand the regulatory mechanisms of enzyme activity in terms of Feedback inhibition, Allosteric Regulation, Covalent Modification and Proteolytic Activation.

CO4. Acquire knowledge in the field of biosensors and immobilized systems, use of enzymes in form of thermophilic enzymes, amylases, lipases, proteolytic enzymes in meat and leather industry, enzymes used in fermentation processes, cellulose degrading enzymes, and metal degrading enzymes.

COURSE: BIOT- Sem-V-IV-P Enzymology

The students will acquire practical knowledge regarding:

CO 1. Estimation of enzyme activity.

CO 2. To study the effect of pH on activity of enzyme.

CO 3. To study the effect of temperature on activity of enzyme.

CO 4. To study the effect of substrate concentration on enzyme activity.

CO 5. To estimate Km and Vmax of an enzyme and plot Line-Weaver Burk plot.

B.Sc. (Hons.) 3rd year (6th Semester)

Genetic Engineering (BIOT-Sem-VI-I-T)

At the end of the course, students will be able to:

CO1. Explain Gene cloning, Learn how the genes can be cut and paste from one organism to another and what are its implications.

CO2. Learn about different types of Polymerase Chain Reaction and their applications.

CO3. Describe about different types of vectors: plasmids, Phage, advanced and commercial .Learn about how to identify recombinants.

CO4. Explain the procedure of preparation of genomic and cDNA library, process of gene identification, techniques of DNA and RNA labeling and Sequencing.

CO5. Discuss about production of recombinant protein in E. coli and in eukaryotic cells.

Practical Outcome

1. Learn demonstration of PCR and Southern blotting the techniques.
2. Able to prepare competent cells.
4. Perform the Transformation of competent cells and blue/white selection.
5. Learn and perform Spectrophotometer analysis of DNA.

Bioprocess engineering and technology Course outcome BIOT-Sem-III-II-T

After successfully completing the course, students will be able to:-

CO1. Learn about the biological terms to describe and analyze phenomena/problems in bioprocesses

CO2. Learn about the fundamentals and principles of engineering addressing the issues bioprocess

CO3. Understand and learn about the sterilization of air and media, design of batch sterilization process. Del factor, sterilization cycle, continuous sterilization process

CO4. Clear the concepts of environmental conditions that influence cell growth and achieve optimal cell growth in large scale

CO5. Analyze microbial growth kinetics or enzyme-catalyzed reactions and identify limiting factors, yield factor, product formation, generation time as well as the substrate utilization

CO6. Design a suitable downstream scheme of bio-product separations from harvested sample based upon the molecular characteristics of the product applying different processes

CO7. Study the design as well as operation of fermenter based upon bio-products and cell lines and other process criteria

CO8. Learn about different components associated with fermenter such as pH probe, DO probe, impellers and spargers

Practical outcome BIOT-Sem-VI-II-P

CO1. Demonstrate the components and sterilization of fermenters and other accessories

CO2. Determine the doubling time, yield coefficient, specific growth rate and maximum specific growth rate for microorganism

CO3. Study the effect of temperature and pH on growth and product formation during fermentation

CO4. Learn about the concepts of cell disruption, and filtration process using various equipments and methods

Food Biotechnology BIOT-Sem-VI-III-T

After successfully completing this course, students will be able to:

CO1. Explain the use of microorganisms in food Biotechnology, History and Scope of Biotechnology.

CO2. Describe the various principles of food preservation.

CO3. Describe contamination, preservation and spoilage of different kinds of foods.

CO4. Explain various kinds of food adulterants and additives.

CO5. Describe fermented foods and their production.

CO6. Explain the process of producing algal, fungal and other microbial proteins.

CO7. Describe various food and water borne diseases.

CO8. Explain rapid and advanced estimation methods for detection of pathogens.

Course: Practicals in Food Biotechnology

After successfully completing this course, students will be able to:

CO1. Isolate and identify microorganisms associated with food spoilage.

CO2. Describe effect of low temperature on microbial growth.

CO3. Explain production and estimation of methanol.

CO4. Describe the process of estimation of lactose in milk.

CO5. Perform methylene blue reductase test (MBRT) for determination of quality of milk.

CO6. Plate the milk samples for microbial contamination.

CO7. Demonstrate the identification of mushrooms by spore prints.

CO8. Check the effect of pasteurization of milk by alkaline phosphatase.

BIOT-Semester-VI-IV-T Genomics and Proteomics

At the end of the course, students will be able to:

CO1. Acquire knowledge about Genomics, Proteomics and databases that store various data about genes, proteins, genomes and proteomes.

CO2. Learn about basic knowledge of genome sequencing, major differences between prokaryotic and eukaryotic genomes, basic proteomics and its applications.

CO3. Explain an overview of applied bioinformatics, comparative, evolutionary, human genomics and functional genomics.

CO4. Work in core facilities and commercial biological and medical laboratories as well as in their postgraduate studies.

Practical Outcome

1. Learn the use of SNP databases at NCBI and other sites

2. Learn the use of OMIM database

3. Detect the Open Reading Frames using ORF Finder

4. Learn about Proteomics 2D PAGE database

5. Understand about Softwares for Protein localization.

6. Draw Hydropathy plots

7. Perform Native PAGE and SDS-PAGE

COURSE: BIOT-Sem-VI-V-T Intellectual property rights and Ethical Issues in Biotechnology and Entrepreneurship.

After completion of the course, the students will

CO 1 Demonstrate basic knowledge about, various types of Intellectual Property Rights, patents and patentable material, history of Indian patent protection, patent filing procedure in India.

CO 2. Acquire knowledge regarding salient features of Indian and foreign patents as well as various social and ethical issues in biotechnology.

CO 3. Gain knowledge and skills related to the fundamental legal principles relating to Patent filing procedure in India, Opposition- pre-grant opposition and post-grant opposition, Patent filing procedure under PCT, copyright, patents, designs, trade mark and Salient features of Indian Patents are discussed in detail.

CO 4. Able to identify, apply and assess principles of law relating to each of these areas of intellectual property. The students will be taught to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.

CO5. Understand current and emerging issues relating to the intellectual property protection of products derived from biotechnology

CO6. Learn the concepts of Entrepreneurship and its types. Special emphasis is laid on Women Entrepreneurship. Selection of a product, product line design and development processes, economics on material and energy requirement will also be discussed.

CO7. Attain the knowledge regarding the basic regulations of excise, demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential is also included.

M.Sc. Biotechnology

PROGRAMME OUTCOME

After successful completion of M.Sc. Biotechnology students will

PO1. Gain basic knowledge about Cell biology, Molecular biology, Recombinant DNA technology and knowledge in supported fields like Bioinformatics, Biostatistics, Animal and plant tissue culture etc. and develop specialized skills.

PO2. Attain extensive laboratory training on course content during practical. Zeal and ability to work safely and effectively in laboratory

PO3. Acquire good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results.

PO4. Participate constructively in classroom discussion and practical work. Also contribute to group work.

PO 5. Proficient to write and present a substantial technical report/document and to plan and write the research papers to present them through seminars.

PO6. Able to implement the scientific skills for development of industrial applications and entrepreneurship.

PO7. Think critically and creatively about the use of Biotechnology to address local and global problems.

PO8. Exhibit articulation of ideas, scientific writings and authentic and relevant reporting, effective presentation skills in seminar

PO9. Attain additional knowledge as the course caters to the requirements providing complete exposure to the NET/SET syllabus of life sciences.

PO10. Excel in the research related to biotechnology and quality control of biologicals.

Programme Specific Outcome

M.Sc. Biotechnology four- semester programme spread over the period of two years. It is designed to offer in depth knowledge of the subjects starting from its basic concepts of biotechnology to state of art technologies used in Biochemistry, Industrial Biotechnology, Recombinant DNA technology, Microbial Biodiversity, Bioinformatics, Biostatistics, Animal and Plant tissue culture. After completion of the course students will

PSO1. Able to design, conduct experiments, analyze and interpret data for investigating problems in Biotechnology and allied fields.

PSO 2 Undertake the project individually, which is essential for strengthening the hands on skill and analytical thinking in designing, conducting and carrying out a research based task individually

PSO3. Moral and ethical awareness/reasoning: While compiling Project report students are encouraged to avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism.

PSO4.Capable to pursue higher studies (M.Phil., Ph.D.) in order to attain research positions.

PSO5. Accomplish to qualify various examinations such as CSIR-NET, ARS-NET GATE, ICMR, DBT etc. that opens channels for promising career in research.

PSO6. Attain skill to achieve position of Production Officer and Technical Assistant in Biotechnology, Pharmaceutical Companies, Bio fertilizer industry, Aquaculture industries, Environmental units, Crop production units, Food processing industries and National bio-resource development firms.

PSO7. Accomplish to open Entrepreneurship ventures in the diverse field of Biotechnology.

PSO8. Discover ample opportunities in academics as well. Students will be able to understand the potentials, and impact of biotechnological innovations on environment and their implementation for finding sustainable solution to issues pertaining to environment, health sector, agriculture,

PSO9. Explore several career opportunities in abroad especially like Germany, Canada, Australia, USA etc.

PSO10. Understand the principle, working, maintain and calibrations of bio-analytical tools and techniques for industrial and research purpose.

M.Sc (Biotechnology) – 1st Semester

MBIO-101: Cell Biology

After successfully completing this course, students will be able to:

CO1. Have comprehensive knowledge on microscopic techniques to be utilized for the study of cellular structures with the finest of details, morphological diversity and general organization of prokaryotic and eukaryotic cells and origin of cells.

CO2. Understand structure and function of cellular organelles, transport of nutrients, ions and macromolecules across membranes and the role of mitochondria and chloroplast in cellular energy transactions.

CO3. Discuss vital cellular processes and their mechanisms and regulation such as Cell cycle, Cell signaling pathways and Cell motility.

CO4. Achieve in-depth knowledge about protein synthesis, intracellular protein trafficking and cellular basis of differentiation and development.

MBIO-101: Practical in Cell Biology

After successfully completing this course, students will be able to:

CO1. Learn the principle, working and parts of bright field microscopy and perform the visualization of sample by using this technique.

CO2. Have-in depth knowledge of principle, types and working of microtomes along with the types of knives used in this technique.

CO3. Separate various sub cellular organelles by using differential centrifugation and density gradient centrifugation, marker enzyme assay to evaluate the purity of obtained fractions.

CO4. Identify the stages of mitosis using onion root tips and meiosis by using onion flower buds.

CO5. Quantitative estimation of DNA in nuclear fraction.

CO6. Learn the technique of vital staining of various organelles in living cells.

MBIO-102 Biomolecules

After the completion of this course, the student will be able to

CO1. Discuss fundamental concept of structure and functions of carbohydrates, proteins, lipids and nucleic acids and their metabolic pathways and their integration.

CO2. Learn how amino acids and proteins are metabolized, emphasizing the role of few intermediates of their metabolism, monitoring the deficiency and abundance disorders of amino acid metabolisms and the role of enzymes in the regulation of the pathways

CO3. Illustrate classification, characteristics and functions of monosaccharides, disaccharides polysaccharides. Epimers, isomers, anomers, chiral carbon atom, chair and boat form, glucopyranose and fructopyranose

CO4. Explain the metabolism of carbohydrates through various anabolic and catabolic pathways like glycolysis, Kreb's cycle, Glycogen metabolism, glucuronic acid cycle etc.

CO5. Learn classification of lipids including Fatty acids- General formula, nomenclature and chemical properties structure, function and properties of simple, complex, acylglycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steroids and prostaglandins. Beta oxidation - Pathway and regulation. Role of acyl carnitine in fatty acyl transport. Synthesis of fatty acid - Structure and composition of fatty acid synthetase complex, pathway and regulation. synthesis of triacyl glycerides

CO6. Describe the Structure of nucleoside, nucleotide. De novo and salvage pathways of nucleotide synthesis. Experimental evidence for nucleic acids as genetic material. Secondary structure of DNA, Watson and Crick model of DNA

Practical outcome

CO1. Understand the methods of preparing the buffer solutions

CO2. Perform the quantitation of cholesterol and sugar and that of DNA, RNA and proteins (Lowry and Bradford methods)

CO3. Find the saponification and acid value of fat

CO4. Separate the amino acids by TLC and analyze the oils-iodine number

MBIO-103: Microbial Diversity and Metabolism

The main objective of this course is to teach students about the areas related to microbiology, its methodology and contribution to humanity and scientific advancement.

At the end of the course, students will be able to:

CO1. Learn the concept of Discovery of the microbial world, controversy over spontaneous generation.

CO2. Gain Knowledge about various Culture media, enrichment culture techniques, pure cultures techniques .Understand various physical and chemical means of sterilization

CO3 Comprehend the various methods for identification of unknown microorganisms and study microbial metabolism – Autotrophy and heterotrophy modes of nutrition Understand the basic microbial structure and functions of various physiological groups of prokaryotes and eukaryotes and also learn the theory and practical skills in microscopy handling and staining techniques

CO4. Understand the microbial physiology and know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement

CO5. Learn the concept of methods in microbiology, pure culture techniques, sterilization, microbial systematic & taxonomy and microbial growth.

CO6. Discuss about physiological aspects of the microorganisms and explain the diversity of microbes and their metabolism.

CO7. Develop concept about the areas related to fungi, viruses, bacteria and archaebacteria.

CO8. Learn the concept of epidemiology and chemotherapy.

Practical outcome

CO1. Prepare the liquid and solid media for growth of microorganisms.

CO2. Perform the isolation and maintenance of organisms by plating, streaking and serial dilution methods.

CO3. Perform isolation of microorganisms pure; cultures from soil and water.

CO4. Learn and perform growth, growth curve, measurement of bacterial population by turbidometry and serial dilution methods.

CO5. Understand effect of temperature, pH, carbon and nitrogen sources on bacterial growth.

CO6. Perform the microscopic examination of bacteria, yeast and molds.

a) Study of organisms by Gram stain
b) Staining of bacterial spores.

CO7. Perform Biochemical characterization (IMViC, Catalase and Urease test) of selected microbes

CO8. Demonstrate One step growth curve of coliphage.

MBIO-105 Biostatistics

Course Outcome

CO1 : Learn about gathering, analyzing data of life sciences and medicine using graphical representation. Describe evaluate the design, including sampling techniques, of a statistical study and demonstrate appropriate sampling and data collection processes.

CO2. Study the concept of averages and measures of dispersion with their applications in the field of biotechnology.

CO3. Students will learn the probability tools for making decisions in the presence of uncertainty and to introduce with Model and analyze measurement data using the appropriate distribution, e.g. normal, binomial, Poisson.

CO4: Compute and interpret the coefficient of correlation and the "line of best fit" for bivariate data.

CO5: Describe the estimation of basic population parameters and perform a hypothesis testing. Construct and interpret confidence intervals to estimate means, standard deviations and proportions for populations.

Practical outcome

CO1: Perform parameter testing techniques, including single and multi-sample tests for means and standard deviations.

CO2: Discussion about test the efficiency of a new drug or medicine which used in clinical investigation.

CO3: To provide orientation of statistics while designing statistical experiments, particularly in agricultural set up and in pharmaceutical production processes.

M.Sc (Biotechnology) – 2nd Semester

MBIO-201 Molecular Biology

At the end of the course, students will be able to:

CO1. Learn the basic techniques in molecular biology, mechanisms of Prokaryotic and eukaryotic DNA replication, in depth knowledge of DNA repair and recombination.

CO2. Gains in depth knowledge about the process of transcription and translation in Prokaryotes and eukaryotes. Describe the concepts of gene regulation in Prokaryotic and eukaryotic cells.

CO3. Explain structure, function and mechanism of action of Oncogenes and tumour suppressor genes. Different types of antisense molecules, applications of antisense and ribozyme technologies.

CO4. Describe construction of Genomic libraries, strategies for DNA Sequencing and recovery procedure of recombinant clones.

CO 5. Techniques of Molecular mapping of genome: different types of molecular markers and their applications

Practical outcome

CO1. Learn and perform to isolate of genomic DNA from blood, bacteria and plant

CO2. Learn and perform to isolate of total RNA from tissue.

CO3. Determine Tm of nucleic acid.

CO4. Demonstrate the DNA protein interaction.

CO5. Perform and learn the Quantitation of nucleic acids and proteins.

CO6. Perform the RFLP analysis.

CO7. Perform the mutagenesis using Yeast (Saccharomyces cerevisiae)

MBIO-202: Biology of Immune System

At the end of the course, students will be able to:

CO1. Learn the concept of immune system, innate and acquired immunity, Organization and structure of lymphoid organs, generation of humoral and cell mediated immune responses, Activation of B- and T- lymphocytes, nature and biology of antigens and super antigens, Antibody structure and function, Antigen-Antibody interactions.

CO2. Describe about Major Histocompatibility complex, B-cell and T-cell receptors and generation of diversity, Complement system. Cells of the Immune system: Heamtopoiesis and differentiation, Regulation of immune response, antigen processing and presentation, Cytokines and their role in immune regulation, T- cell regulation, MHC restriction and immunological tolerance.

CO3. Discuss about cell- mediated cytotoxicity, Mechanism of T cell and NK cell mediated lysis, antibody dependent cell mediated cytotoxicity, macrophage mediated cytotoxicity, Hypersensitivity, Autoimmunity

CO4. Learn the concept of Transplantation, Hybridoma Technology and Monoclonal antibodies, Tumor immunology, Immunity to infectious agents (intercellular parasites, helminthes & viruses), AIDS and other immunodeficiencies.

Practical Outcome

CO1. Perform the blood film preparation and identification of cells.

CO2. Identify and study the lymphoid organs and their microscopic organization.

CO3. Understand the Immunization, collection of serum

CO4. Perform the Double diffusion, immuno-electrophoresis and radial immuno diffusion

CO5. Learn the purification of IgG from serum.

CO6. Learn separation of mononuclear cells by Ficoll-Hypaque.

CO7. Perform the Western- blotting and ELISA methods.

MBIO-203: Biophysical and Biochemical Techniques

After successfully completing this course, students will be able to:

CO1. Learn the principle, instrumentation, applications, advantages and limitations of various biophysical and biochemical tools used in the field of biotechnology.

CO2. Define the basic of chromatography along with basic principle and applications of adsorption and column chromatography. Rf factor, pprinciple, apparatus and applications of gel filtration, affinity, ion exchange chromatography etc.

CO3. Describe the Principle, instrumentation such as types of pumps, columns, detectors etc. used for HPLC along with advantages of HPLC over conventional chromatographic techniques and differences between normal phase and reverse phase chromatography.

CO4. Explain the basic principle, instruments, block diagram and applications of spectroscopic techniques. Define Beer Lambert law, deviations from Beer Lambert law, describe various light sources, parts of monochromator such as prisms and gratings and detectors used for UV/Vis, fluorescence, IR and Raman spectroscopic techniques.

CO5. Describe the principle, instrumentation and applications of MS, ionization modes such as ESI, EI, etc., types of mass analyzers such as Quadrupole, etc., and detectors. Principle, instrument and applications of MALDI-TOF,X-ray crystallography along with methods of crystal formation and mounting of crystals. Define mathematically the Bragg's law, several methods of X-ray diffraction such as rotating crystal method, powder method etc.

CO6. Understand the theory, types and uses of centrifugation, mathematical expression for sedimentation rate, sedimentation coefficient, relation between RPM and RCF. Principle, instrumentation such as design of rotor used for analytical ultracentrifuge and applications of analytical and preparative ultracentrifuges.

CO7. Develop a concept about the principle and applications of agarose gel electrophoresis, PFGE SDS-PAGE along with role of various components of loading buffer, significance of stacking gel and separating gel, isoelectric focusing along with the role of ampholytes, 2D PAGE and various methods used for detecting protein bands on the gel.

CO8. Explain the principle, steps and applications of western, southern and northern blotting and differences between them. Sequencing of proteins using Edman degradation, MS etc.

Sequencing of nucleic acids using Sanger's method etc. and next generation sequencing methods.

CO9. Understand various types and uses of radiotracers to biological systems. Methods for counting and detecting radioactive radiations using proportional, GM and scintillation counter along with their principle, construction and applications.

MBIO-203: Practical in Biophysical and Biochemical Techniques

After successfully completing this course, students will be able to:

CO1. Perform the electrophoresis of proteins under denaturing conditions and non-denaturing conditions by using SDS-PAGE and native PAGE respectively and identify the protein bands using various dyes.

CO2. Demonstrate the principle, working and construction of various parts of mass spectrometer such as ion source, mass analyzers and detectors.

CO3. Demonstrate the principle, working and construction of electron microscope such as SEM and TEM.

CO4. Perform the ion exchange chromatography of proteins by employing cation and anion exchangers.

CO5. Perform TLC of proteins and carbohydrates and to calculate the R_f value of sample spots to identify them.

CO6. Perform the gel filtration chromatography of proteins to separate the proteins according to their size.

Enzymology and Enzyme Technology (MBIO-204)

After the completion of this course, the student will be able to

CO1. Learn application of enzymes have assumed increasing importance both in medicine and in industry and a discussion of these aspects is therefore given prime importance.

CO2. Learn about the characteristics of enzymes, concept of active centre, binding sites, stereo specificity and ES complex formation, activation energy, transition state theory. Effect of temperature, pH and substrate concentration on reaction rate

CO3. Understand Kinetics, catalytic action and control of activity, immobilization methods and various applications of enzymes that are important for industrial application and methods for isolation and characterization of enzymes are now well-established procedures

CO4. Understand the chemical principles of enzyme catalysis, including cofactor chemistry; show insight in the action of enzymes as biocatalysts and in factors that influence enzyme activity;

CO5. Compare methods for production, purification, characterization and immobilization of enzymes and describe the major applications of enzymes in industry, understand the principles of enzyme immobilisation techniques and enzyme extraction procedures

CO6. Understand the mechanism of enzyme action e.g. Lysozyme, chymotrypsin, DNA polymerase etc. and also about zymogens and enzyme activation, Isoenzymes, catalytic antibodies, multi-enzyme complexes and ribozymes

Practical outcome

CO1. Determine the effect of pH, temperature and metal ions on enzyme activity

CO2. Understand the effect of substrate concentration on enzyme activity and demonstration of the Km and V-max of the reaction

CO3. Determine the effect of enzyme concentration on the rate of enzyme catalyzed reaction and inhibitors on enzyme activity.

CO4. Extract and purify the enzymes as well as immobilize them.

MBIO-205 Environmental Biotechnology

After successfully completing the course, students will be able to:-

CO1. Evaluate the potential of biodegradation of organic pollutants, taking microbial and physical/chemical environments, as well as the chemical structure of the compound itself, into consideration

CO2. Understand the phenomenon of phyto-remediation for the decontamination of soil and water, wetlands as treatment processes, biofilms/biofilters for vapor-phase wastes, and composting

CO3. Learn about the environmental quality evaluation, monitoring, and remediation of contaminated environments

CO4. Explain the microbial processes and growth requirements underlying the activated sludge process, nitrification, de-nitrification, enhanced phosphorus removal, and anaerobic digestion

CO5. Identify structure from environmental point of view of relevant organic compounds and account for common sampling techniques for inorganic and organic compounds in soil, water and air

CO6. Understand concepts in effective study design and apply them to a monitoring question of concern and be aware of common bio-indicators and how they are used

CO7. Understand implications of production, resource management, and environmental impact of solid waste management and are aware of significance of recycling, reuse, and reclamation of solid wastes

CO8. Define xenobiotics, degradative, plasmids and bio-remediation and have the understanding of microbial degradation

MBIO-205 Practical outcome

CO1. Analyze the water for portability and determination of MPN by various filter techniques

CO2. Identify and appreciate the parameters for assessing environment such as dissolved oxygen concentration, biological oxygen demand (BOD) and chemical oxygen demand (COD)

CO3. Determine the air pollutant using fibrous air filters and other process criteria

CO4 Learn the isolation of xenobiotic degrading bacteria and isolation for degradation of aromatic hydro carbons

M.Sc (Biotechnology) – 3rd Semester

MBIO-301: Animal Cell Science & Technology

After successfully completing this course, students will be able to:

CO1. L earn about thecell culture and techniques used in laboratory.

CO2. Explain the structure and organization of cell in vivo to the products of animal cell culture containing media formulation, tissue isolation, its processing before and after culture, culture conditions, scale up, precautions, etc.

CO3. Illustrate techniques like hybridoma technology, transformation, transgenesis, and cloning, etc. So conclusively it comprises the basics of processes and their application to start a cell culture and generate the products.

MBIO-301: Practicals in Animal Cell Science and Technology

After successfully completing this course, students will be able to:

CO1. Prepare animal tissue culture medium and its sterilization using membrane filter.

CO2. Prepare the single cell suspension from spleen and thymus.

CO3. Perform the counting of animal cells grown in culture by using hemocytometer and checking the viability of animals cells using dye exclusion and dye uptake assay.

CO4. Grow the macrophage monolayers from PEC and measure the phagocytic activity.

CO5. Perform warm and cold trypsinization of monolayers and subculturing.

CO6. Perform the cryopreservation and thawing of animal cells.

CO7. Analyze human karyotype and study genetic aberrations.

MBIO-302 Genetic Engineering

After completion of the course student will

CO1. Understand the principles of gene manipulation and its associated technologies and application of the genetic engineering.

CO2. Explain techniques and experiments involved to study the structure, behavior and activity of genes and developments in gene manipulation to revolutionize different fields of medicine, agriculture and health

CO3. Learn about Gene cloning vectors: Plasmids, bacteriophages, phagemids, cosmids, artificial chromosomes. BAC, PAC, YAC

CO4. Illustrate procedure of cDNA synthesis, mRNA enrichment, reverse transcription, library construction and screening.

CO5. Describe Restriction mapping of DNA fragments and map construction. Alternative strategies of gene cloning: Sequence dependent screening, screening expression libraries cloning differentially expressed genes. Nucleic acid microarrays.

CO6. Understand about Expression strategies for heterologous genes: Vector engineering and codon optimization, expression in bacteria, transcriptional and translational fusions expression in yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants.

CO7. Discuss Processing of recombinant proteins: Adding tags and signals, tagged proteins, secretion signals, site- directed mutagenesis, synthetic genes and protein engineering.

Practical Outcome

CO1. Preparation of Bacterial culture and antibiotic selection media.

CO2. Perform Preparation of competent cells.

CO3. Learn about Transformation by calcium chloride method.

CO4. Perform Isolation of plasmid DNA and Cloning in plasmid

CO5. Perform Agarose gel electrophoresis, PCR., RE digestion and Southern blot.

MBIO-303 Plant Biotechnology

At the end of the course, students will be able to:

CO1. Learn the concepts of cell and tissue Culture including media composition and preparation, Initiation and maintenance of callus and suspension culture, single cell clones, Organogenesis: Somatic embryogenesis, transfer and establishment of whole plants in soil, production of virus-free plants, Embryo culture and embryo rescue, techniques for protoplast isolation, culture and fusion, selection of hybrid & cybrids and regeneration of hybrid plants, anther, pollen and ovary culture for production of haploid plants, Cryopreservation, and DNA banking for germplasm conversation.

CO2. Describe the concepts and techniques of plant transformation technology: Basic of tumor formation & hairy roots, features of Ti and Ri plasmids, mechanisms of DNA transfer, use of Ti and Ri as vectors, binary vectors, concepts of promoters, genetic markers, reporter genes, methods of nuclear transformation, viral vectors and their applications, Multiple gene transfers and vector less or direct DNA transfer, transgene stability and gene silencing.

CO3. Applications of plant transformation for productivity and performance: Herbicide resistance, Insect resistance, virus resistance, disease resistance, nematode resistance, resistance to abiotic stress, Long shelf life of fruits and flowers- Use of ACC synthase, polygalacturanase, ACC Oxidase Male sterility, bar and barnase systems, carbohydrate composition and storage

CO4. Discuss about chloroplast Transformation: Advantages, vectors, success with tobacco and potato, Production of plant secondary metabolites in vitro, control mechanisms & manipulation of phenyl propanoid pathway, shikimate pathway, alkaloids, role of bioreactor for scaling up, elicitation, biotransformation, Industrial enzymes, Biodegradable plastics, Molecular pharming in plants- Production of therapeutic proteins, antibodies, edible vaccines purification.

CO5. Explanation of molecular marker-aided breeding: RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (Sequence Characterized Amplified Regions), SSCP (Single Stand Conformational Polymorphism), AFLP, QTL, map based cloning, molecular marker assisted selection in plant breeding, Green house and Green-Home technology.

Practical outcome

CO1. Learn and perform the Methods of sterilization and Preparation of media-MS (full strength, half strength).

CO2. Perform Callus induction & sub culturing, organogenesis.

CO3. Perform counting, staining and cytology of cultured cells

CO4. Learn Suspension cultures and their maintenance.

CO5. Perform anther culturing and micro propagation.

CO6. Perform Agro bacterium mediated transformation for hairy root culture

MBIO-304: Bioprocess Engineering and Technology

At the end of the course, students will be able to:

CO1. Describe about the bioreactor design, control panels of a bioreactor and types of bioreactors and will be able to operate of bio-reactors

CO2. Gain comprehensive knowledge about media constituents, formulations and microbial growth as well as measurement of cell biomass and analysis of mass balance, different methods of sterilization, agitation, oxygen transfer rate

CO3. Analyze and identify limiting factors in bioprocess engineering and propose solution to address these problems

CO4. Apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyze bioprocesses. The student will also be able to produce, analyze and interpret data from bioprocesses

CO5. Develop the capacity of production processes and control of aerobic and anaerobic systems, solve calculation based on process economy as well as to recognize the importance of flow sheet of the production system.

CO6. Design a suitable downstream scheme of bio-product separations from harvested sample based upon the molecular characteristics of the product applying different processes

CO7. Learn about the fermentations and fertative processes like submerged, solid state, batch, fed batch, continuous system etc and also about the hygiene and safety in fermentation laboratory/process

Practical Outcome

CO1. Isolate industrially important microorganisms for microbial processes.

CO2. Perform and Determine thermal death point (TDP) and thermal death time (TDT) of microorganism for design of a sterilizer.

CO3. a). Determine the growth curve of a supplied microorganism and also determination of substrate degradation profile
b). Compute specific growth (m), growth yield (Yx/s) from the above.

CO4. Learn Production and estimation of alkaline protease and alcohol.

CO5. Demonstrate fermenters and its functioning.

CO6. Perform Cell disruption method and analysis

MBIO-305: Advances in Genomics and Proteomics

At the end of the course, students will be able to:

CO1. This paper is having a great importance in order to understand the intricate nature of gene/Genome, gene expression.

CO2. Student's gets an understanding about the major techniques such as PCR, protein arrays next generation sequencing technologies and search databases etc.

CO3. Students are made familiarized with the modern methods of protein detection and sequencing, analysis of protein by important techniques such as electrophoresis, protein arrays and mass spectroscopy along with its role in the drug development process.

CO4. This paper helps students to work in core facilities in reseacrh laboratories as well as in their further studies.

Practical outcome

CO1. Perform Gene identification software: GLIMMER, GRAIL

CO2. Perform GEO, Stanford Microarray database

CO3. Perform SWISS 2D PAGE

CO4. Perform NCBI Genome

CO5. Perform STRING, BIND, GRID, DIP

M.Sc (Biotechnology) –4th Semester

MBIO-401 Stem Cell and Regenerative Medicine

CO1. Learn basics of stem cell, types, and molecular markers.

CO2. Understand the signal transduction mechanisms involved in the development of the cell.

CO3. The differentiation pattern of stem cell and application of stem cell therapy in the medicine and tissue engineering to overcome the fatal disease in human.

MBIO- 402: Drug Designing and Drug Delivery

At the end of the course, students will be able to:

CO1. Understand fundamental and advanced principles for optimizing drug delivery, various aspects of drug designing including computer-aided drug design, drug discovery, biology of disease and effective strategies for drug delivery.

CO2. Explain an overview of Insilco Approaches of Drug Designing. Complete process of Drug designing (Selection of the target, Identification, characterization, validation of the Target/s in reference to the Gene or Protein of our interest, designing of Ligand/s, Interaction studies of Ligand/s, docking studies etc.),

CO3. Learn Process of handling of Drug by the body, New drug approval process, Clinical trial planning and design and Drug delivery systems.

CO4. Prepare students who want to work in CRO's, Pharmaceutical companies or want to opt for further research in this area.

MBIO- 403 Intellectual Property Rights, Biosafety & Bioethics:

After the completion of this course, the student will be able to

CO1. Explain various aspects of IPR, Biosafety and bioethics

CO2. Learn advances made in application of biotechnology for the benefit of human being. and use of recombinant DNA technology or modern biotechnology that has generated a number of useful applications and products in agriculture, medical application, animal husbandry, industrial production and environmental management.

CO3. Understand about Intellectual property legal rights resulting from intellectual activity in the Industrial and scientific fields are very important.

CO4. Gain knowledge about IP systems that protect certain well-defined subject matter by giving limited entitlements to eligible right holders to exclude others from certain uses of the protected material.

CO5. Learn about safety concerns and ethical issues on application of biotechnology will be discussed under the current issues associated with the benefits and risk concerns on Biotechnology.

CO6. Describe regulatory authorities of India: MOEF, DBT and GEAC and International regulatory authorities: EPA, USDA, FDA, APHIS

CO7. Illustrate International agreements relevant to biological inventions: Paris convention, PCT, UPOV, Budapest Treaty, EPC

Practical outcomes MBIO- 403

CO1. Perform patent search: Indian Patent (IP India) and USPTO

CO2. Understand International/National case study in context to patenting in biotechnology

CO3. Patent drafting (Provisional and complete specifications)

MBIO-404 Seminar

CO1. Provide the knowledge of latest happening in the field of Biotechnology

CO2 Improve communicational skill

CO3 Learn to prepare and present power point presentation for Seminars covering latest topics in Biotechnology

MBIO-405 Research Project

CO1. Gain sufficient experience and proficiency in the research methodology

CO2 Enable students to carry out independent research.

CO3 Projects assigned as per individual's interest under the supervision of specialized faculty are carried out in labs of the Department

CO4. Compilation and submission of dissertation

CO5. Learn to prepare for viva-voice

CO6: Give presentation of their scientific findings and learn how to defend them.

CO7: Practical skills, handling of lab equipment's, preparation of reagents lab safety measures

M.Sc Microbial Biotechnology

Program outcome

After successful completion of M.Sc. Microbial Biotechnology students will be able to

PO1. Become competent Microbial Biotechnologists who can employ and implement their knowledge base in premium processes and applications which will profoundly influence or utilized the existing paradigm of agriculture, industry, healthcare and restoration of degraded environment to provide sustainable competitive edge to present society.

PO2. Attain Good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analysis of data and interpretation of results.

PO3. Carry out research/ investigation independently in specialized area of biotechnology.

PO4. Gain research experience within a specific field of biotechnology, through faculty supervised master dissertation (project). In the final semester every student has to undertake the project, which is essential for strengthening the hands-on skill and analytical thinking in designing, conducting and carrying out a research-based task individually.

PO5. Write and present a substantial technical report/document and to plan and write the research papers to present them through seminars.

PO6. Use knowledge from several disciplines (multidisciplinary approach).

PO7. Recognize the need for continuous learning and will prepare oneself to create, select, learn and apply appropriate techniques, resources, and modern instrumentation to solve the problems relevant to modern biology to cater the needs of biotechnology and microbial industries.

PO8. Analyse the texts, evaluating ideas and scientific strategies and to formulate logical and convincing arguments.

PO9. Grasp the ideas and to turn ideas into action related biochemical mechanisms and processes related to industries, production, health, agriculture.

PO10. Develop the ability to plan and manage projects in order to achieve objectives.

Programme Specific Outcome

After successfully completing M. Sc. (Microbial Biotechnology) Programme students will

PSO1. Successfully carry out advanced tasks and projects, both independently and in collaboration with others across various discipline

PSO2. Develop strong competencies in biotechnology and its applications in a technology rich interactive environment

PSO3. Compete for employment in biotechnology-based research and development sectors, industrial sectors, teaching and to offer a wide range of experience in research methods, data analysis to meet the industrial needs

PSO4. Pursue higher studies (M.Phil., Ph.D.) in order to attain research positions. Various examinations such as CSIR-NET, ARS-NET GATE, ICMR, DBT and many other open channels for promising career in research

PSO5. Attain position of Production Officer and Technical Assistant in Biotechnology, Pharmaceutical Companies, Bio fertilizer industry, Aquaculture industries, Environmental units, Crop production units, Food processing industries and National bio-resource development firms.

PSO6. Explore Entrepreneurship ventures or take up projects relevant to industrial needs as well as research and development activities.

M.Sc. 1st year (Ist semester) Microbial Biotechnology

MBT-101-T

Microbial Biodiversity and Physiology

After successfully completing the course, students will be able to:-

CO1. Understand history, relevance of microbiology Historical milestones in Microbiology and Biotechnology

CO2. Gain knowledge of various (physical and chemical) methods of control of microorganisms and safety measures to be followed while handling microbes

CO3. Learn about the rules governing the different taxonomy and classification systems and the salient features of the different microbial groups such as Archae, Bacteria, Algae, Fungi, Viruses, extremophiles etc.

CO4. Gain an in-depth knowledge of primary, secondary and group translocation transport systems existing in bacteria, simultaneously learning membrane transport proteins and kinetics of solute transport

CO5. Explain various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

CO6. Get acquainted with methods of measuring microbial growth, calculating growth kinetic parameters with understanding of steady state and continuous growth

CO7. Describe the types of symbiosis and antibiosis with examples such as microbe-microbe, microbe-animal, microbe-plant interactions.

CO8. Understand the regulation of biochemical pathway and possible process modifications for improved control over microorganisms for microbial product synthesis

CO9. Understand major fermentation, aerobic and anaerobic pathways for energy generation in microbial cells

Practical outcome MBT-101-P

CO1. Learn the use of basic instruments in Microbiology (Light microscope, pH meter, Autoclave, Laminar flow chamber, Centrifuge, Spectrophotometer)

CO2. Determine and Correlate viable counting and optical density of cultures

CO3. Learn purification and isolation methods for microbes and mixed cultures by streaking technique from environment

CO4. Gain knowledge about preparation of different media: synthetic media, complex media

CO5. Learn about sterilization processes for liquid and solid items and also gain knowledge about storage methods for microbes

MBT 102-T Immunology and Immunotechnology

At the end of the course, students will be able to:

CO1. Learn about Overview of the human immune response: adaptive and innate immunity; immune cells and immune organs Also about B cell biology and T cell biology: Development, basic functions of cells during immune response, T cells subsets

CO2. Understand about Immunoglobulins: Structure and functions of Immunoglobulins, Immunoglobulin rearrangement, molecular genetics of BCR generation also about the Antigens, haptens and adjuvants

CO3. Learn about Major Histocompatibility Complex (MHC): Structure, function and immunogenetics of MHC, MHC-TCR interactions, cell biology of antigen processing and presentation, Chemokine, cytokine and cell signaling: Their roles in activation and differentiation of cells of immune system, importance in response to pathogens

CO4. Describe about Antigen-antibody reactions, interaction, cross reactions, precipitation and agglutination able to perform Radioimmunoassay, ELISA, Western blotting, Hybridomas and Monoclonal antibodies and also study recent advances in immunological tools for diagnosis of diseases

CO5. Understand about immune response to infectious diseases: Responses to different classes of pathogens such as intracellular bacteria, viruses and extracellular and intracellular parasites, Vaccines and their types: killed and live, sub unit, recombinant, multivalent, DNA, edible vaccines, Cancer: immune-surveillance, tumor antigens, immunological intervention

Practical Outcome MBT 102P

CO1. Perform Total Leukocyte Count (TLC) and Differential Leukocyte count (DLC) of blood samples

CO2. Learn to Isolate peripheral blood mononuclear cells from blood samples

CO3. Perform Determination of cell viability

CO4. Perform Immunoassays

CO5. Understand about Animal handling, Routes of immunization and Drawing blood from animals

MBT-103T: Genetics and Recombinant DNA Technology

At the end of the course, students will be able to:

CO1. Describe basic concepts of genetics, genetic recombination and Gene mapping techniques.

CO2. Define mutagens, mutations and its type. Understand DNA Repair mechanisms

CO3. Learn strategies Gene cloning, tools of recombinant DNA technology and methodology of construction of genomic, and meta-genomic cDNA Combinatorial library libraries.

CO4. Explain PCR, Phage display technology and Yeast two-hybrid system along with applications.

Practical outcome MBT-103-P

CO1. Perform Isolation of chromosomal DNA

CO2. Perform Isolation of plasmid

CO3. Learn preparation of competent cells

CO4. Perform transformation and Electroporation

CO5. Perform restriction digestion (complete and partial) of DNA

CO6. Perform cloning and expression of a gene in E.coli

CO7. Perform Amplification of DNA by PCR

MBT-104; Microbial Biochemistry and Enzymology

After the completion of this course, the student will be able to

CO1. Describe the concepts of pH, buffers, Henderson-Hasselbalch equation, biological buffer systems and their importance.

CO2 Give overview of major biomolecules –carbohydrates, lipids, proteins, amino acids, nucleic acids, classification, structure, function, significance and biosynthesis and the degradation pathways of the biomolecules

CO3 Understand the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems and about various biochemical reactions and metabolic pathways.

CO4. Learn how amino acids and proteins are metabolized, emphasizing the role of few intermediates of their metabolism, monitoring the deficiency and abundance disorders of amino acid metabolisms and the role of enzymes in the regulation of the pathways

CO5. Understand the regulation of biochemical pathway and possible process modifications for improved control over microorganisms for microbial product synthesis.

CO6. Gain conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation, enzyme engineering, Application of enzymes in large scale industrial process

CO7. Understand the chemical principles of enzyme catalysis, including cofactor chemistry; show insight in the action of enzymes as biocatalysts and in factors that influence enzyme activity

Practical outcome MBT-104P

CO1. Perform the Qualitative and quantitative assay of Sugars, lipids, proteins and nucleic acid

CO2. Determine the effect of pH, temperature and metal ions on enzyme activity.

CO3. Understand the substrate specificity and efficiency of enzymatic catalysis.

CO4. Perform different assay methods for analysis of enzyme and also the enzyme immobilization

CO5. Perform the kinetics of enzyme catalysed reactions

Bioprocess Engineering Course outcome MBT-105-T

After successfully completing the course, students will be able to:-

Theory

CO1. Describe about the bioreactor design, control panels of a bioreactor and types of bioreactors and will be able to operate of bio-reactors.

CO2. Gain comprehensive knowledge about media constituents, formulations and microbial growth as well as measurement of cell biomass and analysis of mass balance, different methods of sterilization, agitation, oxygen transfer rate

CO3. Analyze and identify limiting factors in bioprocess engineering and propose solution to address these problems

CO4. Apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyze bioprocesses. The student will also be able to produce, analyze and interpret data from bioprocesses

CO5. Develop the capacity of production processes and control of aerobic and anaerobic systems, solve calculation based on process economy as well as to recognize the importance of flow sheet of the production system.

CO6. Design a suitable downstream scheme of bio-product separations from harvested sample based upon the molecular characteristics of the product applying different processes

CO7. Learn about the fermentations and fertative processes like submerged, solid state, batch, fed batch, continuous system etc. and also about the hygiene and safety in fermentation laboratory/process

Practical outcome MBT-105-P

CO1. Learn about the bioreactor design, control panels of a bioreactor and types of bioreactors and will be able to operate of bio-reactors

CO2. Understand about batch fermentation and production of enzyme in shake flask using different microbial cultures and analyze the product formation

CO3. Describe about fermentation and purification strategies for proteins/polysaccharides such as Ultracentrifugation, chromatographic methods, two phase aqueous separations, solvent – solvent extraction, centrifugation, pre treatment, crystallization etc

CO4. Learn about Hygiene and safety in fermentation laboratory/processes

CO5. Gain knowledge about solid state fermentation

M.Sc (‘1 st year) Microbial Biotechnology2nd semester

MBT-201T: Medical Microbiology

After successfully completing this course, students will be able to:

CO1. Learn about the basic concepts of infectious diseases: host parasite relationship; molecular Koch postulates; modes of transmission; virulence and pathogenicity; pathogenesis of infectious diseases; microbial mechanisms for escaping the host defenses; measures of disease occurrence and outcome, Microbial toxins and their cellular targets, Quorum sensing and microbial pathogenicity

CO2. Understand about molecular pathogenesis of infections caused by intracellular bacteria, with an emphasis of Salmonella, Shigella, Listeria monocytogenes and Rickettsia

CO3. Describe about virulence mechanisms of other bacterial pathogens including Streptococci, Corynebacterium diphtheriae, Bordetella pertussis, Bacillus anthracis, Vibrio cholerae, pathogenic E. coli, Clostridium botulinum, Clostridium tetani, Clostridium perfringens, Helicobacter pylori, Yersinia pestis, Brucella abortus, Treponema pallidum, Borrelia burgdorferi.

CO4. Learn about Overview of viral pathogens, including Herpesviridae, Orthomyxoviridae, Paramyxoviridae, Flaviviridae, Hepatitis viruses, Rabies virus, Rhinovirus, Norwalk virus, Papilloma virus, Polio virus; Prion diseases , Viruses that changed the world: HIV and Ebola , Common fungal infections.

CO5. Gain knowledge about antimicrobial drugs and their cellular targets, antimicrobial susceptibility testing in clinical laboratories, mechanisms of drug resistance in microbes, microbial biofilms and their clinical implications.

Practical outcome 201P

CO1. Perform culture identification of representative Gram-positive bacterial pathogens: Staphylococcus, Streptococcus.

CO2. Perform culture identification of representative Gram-negative bacteria: E. coli, Salmonella, Shigella, Proteus, Klebsiella, Pseudomonas.

CO3. Perform culture identification of fungal pathogens (Candida, Aspergillus).

CO4. Perform antimicrobial susceptibility testing of pathogenic bacteria 5. Collection, handling and storage of clinical samples.

MBT-202T Molecular Biology;

After successfully completing this course, students will be able to:

CO1. Learn the chemical structure and different types of DNA. Genomic organization in prokaryotes and eukaryotes.

CO2. Detail difference between prokaryotic and eukaryotic DNA Replication.

CO3. Describe in detail about central dogma of life. Explain transcription process in prokaryotes and eukaryotes. Characterize Genetic code

CO4. Understand translational process in prokaryotes.

CO5. Explain the concept of gene regulation. Define Operon model.

CO6. Gain in depth knowledge of RNA synthesis and processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA and RNA transport.

CO7. Describe the process of Protein synthesis, processing, translation proof-reading, translational inhibitors and Posttranslational modification of proteins.

Practical outcome 202P

CO1. Perform spectrophotometric analysis of DNA

CO2. Perform Isolation of RNA

CO3. Learn characterization of different types of RNA molecules

CO 4. Learn construction of cDNA

CO5. Perform separation of Escherichia coli soluble proteins on non-denaturing gels.

CO6. Perform separation of Escherichia coli total proteins on denaturing gels.

CO7. Learn Cell Proliferation/Cytotoxicity assays

MBT-203-T: Industrial Microbiology –I (Health, Food, Enzymes)

After successfully completing this course, students will be able to:

CO1. Define Primary and Secondary metabolites. Understand techniques involved in screening of industrially important metabolites from microbes and their strain improvement.

CO2. Discuss biosynthesis and fermentation processes involved in production of antibiotics, alkaloids and therapeutic proteins. Discuss Beer, Wine, Whisky, and Vinegar, Vitamins, Bio flavours and traditional fermented foods production.

CO3. Describe diverse range of microbial enzymes and their application in detergent, processing of starch and related carbohydrates, fruit juice production, textile and leather manufacture etc.

CO4. Understand the role of microbial enzymes in organic synthesis and diagnostics.

CO5. Explain the concept of immobilization of enzymes and cells and their applications.

Course: MBT-203-P: Practical of Industrial Microbiology –I (Health, Food, Enzymes)

After successfully completing this course, students will be able to:

CO1. Perform primary and secondary screening and isolation of microbes for production of industrially important enzymes.

CO2. Optimize media composition, incubation temp and time, aeration etc. for optimal production of enzymes.

CO3. Perform fermentation of wine.

CO4. Purify antimicrobial metabolites from a microbe.

CO5. Perform enzyme immobilization by using various matrices.

CO6. Design of fermentation process for production fuels for example bioethanol, bio-based chemicals and foodstuffs.

MBT-204: Bioinformatics and Biostatistics

After successfully completing this course, students will be able to:

CO 1 Attain basic understanding of computers and overview of programming languages in reference to biological Sciences.

CO 2 Understand Biological data, Biological Databases, Sequence retrieval tools and methods to characterize and manage the different types of biological data.

CO 3. Learn the basic concepts of Alignments (Local/Global Pairwise/MSA), along with the major software/s associated with MSA's.

CO4. Describe Database Scanning and Sequence similarity searches using Tools/Databases/Algorithms.

CO 5. Discuss basics of various major gene prediction methods.

Practical Outcome MBT 204P

CO1. Perform sequence (DNA & Protein) alignments

CO2. Learn Genome sequence studies

CO3. Design ideal primers for amplification of genetic material

CO4. Learn Deciphering 3-D structure of proteins

CO5. Design inhibitors of enzymes

MBT-205-T Intellectual Property Rights (IPR) Bioethics & Entrepreneurship Course outcome

After successfully completing the course, students will be able to:-

CO1. Understand the rationale for and against IPR and especially patents and Understand why India has adopted an IPR Policy and be familiar with broad outline of patent regulations

CO2. Explain different types of intellectual property rights in general and protection of products derived from biotechnology research and issues related to application and obtaining patents;

CO3. Gain knowledge of bio-safety and risk assessment of products derived from recombinant DNA research and environmental release of genetically modified organisms, national and international regulations

CO4. Discuss ethical aspects related to biological, biomedical, health care and biotechnology research.

CO5. Learn basic knowledge on intellectual property rights and their implications in biological research and product development;

CO6. Gain entrepreneurial skills and understand the various operations involved in venture creation,

CO7. Identify scope for entrepreneurship in biosciences and utilize the schemes promoted through knowledge centers and various agencies.

CO8. Gain knowledge pertaining to management should also help them to build up a strong network within the industry.

CO9. Gain knowledge about IT Act, 2000 : Aims and Objectives; Overview of the Act; Jurisdiction; Role of Certifying Authority; Regulators under IT Act; Cyber Crime-offences and Contraventions; Grey Areas on IT Act.

Practical outcome MBT-205-P

CO1. Search about Indian and international patent databases such as Indian patent office, USPTO, EPO etc

CO2. Learn about drafting and filing Indian and international patent applications

CO3. Formulate well-structured research questions, recognize appropriate research methods, and assess research reports

M.Sc Microbial Biotechnology (2nd year) Semester 3

MBT 301T Advances in Microbial Biotechnology (Genomics, Proteomics & Metabolomics)

After completion of the course students become able to

CO1 Understand the intricate nature of gene/Genome, gene expression.

CO2 Describe about the major techniques.

CO3. Explain modern methods of protein detection and sequencing, analysis of protein by important techniques such as electrophoresis, protein arrays and mass spectroscopy along with its role in the drug development process.

CO4. Gain knowledge about Genome sequencing of different microbes and their importance , Techniques for genome research (chromosome walking, RFLP etc.)

CO5. Understand about Microbial pathogenesis at the proteome level , proteome research for novel drug targets, structural proteomics and computational analysis, proteomics of Archaea , high throughput proteomic screening for novel enzymes

Practical outcome MBT-304 P

CO1. Perform RAPD/RFLP/16S rRNA-sequencing of bacterial isolates (e.g., Escherichia coli isolates) and phylogenetic tree construction

CO 2. Perform isolation of metagenomic DNA from soil or water source

CO3. Learn demonstration of 2-D gel electrophoresis

CO4. Learn demonstration of MALDI – ToF

CO5. Learn demonstration of DNA/Protein Microarray system

CO6. Perform practicals on Microbial Genomics/Proteomics/Metabolomics using computational tools.

CO7. Learn comparison of genomes. Genome projects and sequence archive databases.

MBT-302T Industrial Microbiology-II

At the end of the course, students will be able to:

CO1. Understand the benefits of microbes or their products in cleaning the environment such as use of microbes in wastewater treatment, bioremediation and biomining, production and application of biodegradable plastics, bioinsecticides and biofertilizers.

CO2. Discuss large scale production of useful microbial biomass such as Baker's Yeast, Spirulina and mushroom.

CO3. Describe probiotics, prebiotics, symbiotic and their properties, function and role in human health.

CO4. Explain the role of microbes in biofuel production especially Ethanol, Butanol, Methane and Hydrogen- organic acids such as Amino acids, Citric acid, Acetic acid, Lactic acid and production of Exopolysaccharides.

CO5. Have an understanding of protocols such as good lab practices guidelines, good manufacturing processes guidelines, guidelines for the use of recombinant microbes, equipment, analytical method and process validation.

Practical outcome MBT-302P

CO1. Perform estimation of BOD levels of a water sample

CO2. Perform isolation of P-solubilizers from the soil

CO3. Perform estimation of P-solubilizing activity of P-solubilizer

CO4. Learn Isolation of Lactobacilli from milk/ curd

CO5. Learn production of bacteriocin by probiotics

CO6. Understand the effect of temperature on the preparation of curd from milk

CO7. Understand the effect of type of milk on the preparation of curd from milk

MBT-303-T: Bioinstruments and their Applications

After successfully completing this course, students will be able to:

CO1. Learn the principle, instrumentation, applications, merits and demerits of various bioinstruments and bioanalytical tools used in the field of microbial biotechnology for the isolation and purification of microbial cell biomolecules.

CO2. Explain the principle, ray diagram and applications of light microscopy, phase contrast microscopes, AFM, STM etc. Differentiate between bright field and dark field microscopes, between light microscope and electron microscopes and between SEM and TEM.

CO3. Understand the basic principle, instruments, block diagram and applications of spectroscopic techniques. Define Beer Lambert law, deviations from Beer Lambert law. Different parts of monochromator such as prisms and gratings and detectors such as PMT etc. used for UV/Vis, IR and Raman spectroscopic techniques. Various vibrational modes and significance of fingerprint region of IR spectra. Stokes shift and anti-stokes shift of Raman spectra. Differentiate between IR and Raman spectroscopy and CD AND ORD. Principle behind NMR and ESR, hyperfine splitting etc. and elucidation of structure of biomolecules using them.

CO4. Explain the theory of centrifugation, mathematical expression for sedimentation rate, sedimentation coefficient, relation RPM and RCF. Types and uses of centrifuges such as bench top, refrigerated high speed centrifuges etc. Classification and uses of rotors into vertical, fixed angle and swimming bucket rotors. Types and applications of preparative centrifugation such as differential, rate zonal and buoyant density centrifugation and types of analytical centrifugation such as sedimentation velocity and sedimentation equilibrium.

CO5. Develop a concept about the principle behind electrophoresis along with factors affecting it. Electrophoresis of nucleic acids such as principle, working and applications of agarose gel electrophoresis, PFGE etc. Electrophoresis of proteins such as principle, working and applications of SDS-PAGE, significance of stacking gel and separating gel, isoelectric focusing along with the role of ampholytes, 2D PAGE etc. Role of various components of loading buffer and how to detect nucleic acids and protein bands on the gel.

CO6. Define the basic terms used in chromatography such as mobile phase, stationary phase, elution, etc. Principle, applications, instrumentation with major emphasis on types of detectors and columns used for gas chromatography. Define R f factor, types and applications of paper chromatography such as ascending, descending paper chromatography etc. Principle, equipment and applications of TLC along with types of stationary phase, backing plate and solvents used. Describe the Principle, instrumentation such as types of pumps, columns, detectors etc. used for HPLC along with advantages of HPLC over conventional chromatographic techniques. Explain the principle, apparatus and applications of FPLC.

CO4. Develop a concept about physical basis of X-ray crystallography along with methods of crystal formation and mounting of crystals. Define mathematically the Bragg's law, several methods of X-ray diffraction such as rotating crystal method, powder method etc. Principle, instrumentation and applications of electron and neutron diffraction.

CO5. Explain various types and uses of radiotracers to biological systems. Methods for counting and detecting radioactive radiations using proportional, GM and scintillation counter along with their principle, construction and applications. Graphical relation between applied voltage and count rate, quenching of GM and scintillation counters. Mechanism, principle and applications of autoradiography and types of isotopes used for it.

CO6. Describe the various steps followed for protein purification workstation, quality control for protein sample preparation for MS, collaboration between MS and chromatographic techniques such as GCMS and LCMS along with the applications and types of columns and ionization modes used specifically for these. Describe the principle, instrumentation and applications of MS, ionization modes such as ESI, EI, etc., and types of mass analyzers such as Quadrupole, etc., and detectors. Principle, instrument and applications of MALDI-TOF.

Course: MBT-303-P: Practical in Bioinstruments and their Applications

After successfully completing this course, students will be able to:

CO1. Operate electron microscopes to visualize microscopic sample and to obtain highly resolved and magnified images by using SEM and TEM, learn their various parts and their working.

CO2. Run TLC of a given sample and to calculate the R f value of sample spots to identify them.

CO3. Operate microfuge, high speed centrifuge and ultracentrifuge to separate the sample components according to their size, shape and density.

CO4. Operate GC and learn the working of its various parts such as sample injectors, columns, oven, detectors, etc. to separate the mixture of protein sample.

CO5. Operate HPLC and learn the working of its various parts such as sample injectors, columns, types of pumps, detectors, etc. to separate the mixture of protein sample.

CO6. Operate MS, learn the working of its various parts such as ion source, mass analyzers and detectors for separation of proteins according to their mass/ charge ratio and to plot the mass spectrum.

CO7. Operate LCMS, learn to interface HPLC with MS.

CO8. Operate NMR, learn the working of its various parts and obtain the NMR spectra.

MBT-304T Microbial Identification, Diagnostics and Nano-biotechnology:

After the completion of this course, the student will be able to

CO1. Gain knowledge of diagnosis and treatment of disease at molecular level. Understand the entire repertoire of DNA, RNA and protein is essential for understanding all the phenotypes or traits (such as susceptibility to disease, response to a drug) of an organism.

CO2. Learn various methods used in microbial identification, various diagnostic procedures followed and applications of nanotechnology in biotechnology

CO3. Explain basic concepts of medical microbiology, identification and the clinical concepts of microbiology and relate it to diagnostic procedures used in laboratories.

CO4. Gain knowledge about basic concepts of nanobiotechnology and the aspects of nanomaterial synthesis.

CO5. Understand the techniques of DNA based diagnosis and treatment, techniques of immunological diagnosis and treatment, In situ nucleic acid hybridization and amplification, Kits used in modern disease diagnosis laboratory, use of different techniques for analyzing nanoparticles and studying their properties.

Practical outcome MBT 304P

CO1. Understand case studies in infectious disease diagnostics: clinical-case discussions

CO2. Prepare and perform chromogenic media for microbial identification

CO3. Learn about microbial identification using VITEK, BACTEC, BIOLOGS and FAME

CO4. Do microbial identification and typing by molecular methods

CO5. Practice on biosensors and perform microbial synthesis of nanoparticles

MBT-305-T:Tutorials

After successfully completing this course, students will be able to:

CO1. Learn the new and advanced techniques and recent concepts emerging in microbial biotechnology such as basics of QPCR; myths about diseases such as TB, rabies etc.; concept of giant viruses; biosafety, biosecurity, BMWM and DURC, salient features of PVC superphylum, diversity of AMPs; role of integrons in MDR, non-rhizobium PGPRs

to improve crop productivity, applications of radiations in diagnostics, principles of fluorescence and applications of non-aqueous enzymology.

CO2. Explain the principle and procedure behind QPCR, how QRT-PCR works, two step and one step QRT-PCR, instrumentation, types, detection chemistries, standardization of QRT-PCR, types of real time quantitation such as absolute and relative quantitation, Quantitative and melting curve analysis, normalization such as normalization with genomic DNA, total RNA, applications etc.

CO3. Understand the good and bad sides of QPCR such as edge over conventional PCR and limitations of QPCR, problems of QPCR

CO4. Describe the myths and misconceptions associated with various diseases.

CO5. Develop a concept about the characteristics of giant viruses and virophages, explain the morphological features, replication cycle, and gene content of Mimivruse, Pandoravirus, Pithovirus and Mollivirus, current views and debates on evolution of giant viruses such as virion is not a virus etc., reductive evolution, evolutionary origins etc.

CO6. Define and differentiate biosafety and biosecurity, conventions on biosafety and biosecurity, biosafety and biosecurity activities outside the convention such as ABSA, A-PBA, WHO, OECD etc., risk management standards for biosafety and biosecurity such as risk assessment, treatment, monitoring and communication, main elements of biosafety etc.

CO7. Explain the classification of biohazards as chemical, biological and physical hazards, classification of pathogenic microbes on the basis of capability and severity of infections caused by the, route of entry etc. into risk group I, II, III, IV and V along with their examples, types of containment

CO8. Understand the concept of dual use research of concern (DURC), roadmap to addressing DURC, basic biosafety, biosecurity and limitations of DURC policies, DURC review process, international oversight of DURC, principles of dissemination of life science research of concern, contribution of DURC to biosafety and biosecurity, managing DURC, solutions to challenges of DURC, role of NSABB board on biosecurity, criteria for identifying DURC, role of IRE etc.

CO9. Develop the concept of biomedical waste management (BMWM), process flow of BMWM, categories of biomedical waste and its segregation. International conventions on BMWM, BMWM outside India and in India, salient features and challenges in implementation of Biomedical waste rule 2016 and its amendments

CO10. Explain the exceptions to classical bacterial classifications such as PVC superphylum as exceptions to the bacteria, Planctomycetes, Verrucomicrobia, Chlamydiae, and several others consisting of yet to be cultured members, historical controversies in PVC research, diversity of PVC

CO11. Explain the diversity of antimicrobial peptides (AMPs), classification of AMPs based onthe structure such as amphipathic and hydrophobic alpha-helices, beta-sheet peptides and small proteins, genes coding them, their post-transcriptional modification, action mechanism and resistance mechanism.

CO12. Understand the role of integrons in microbial drug resistance, adaptive functions propagated by integrons by conferring the antibiotic resistance traits, integrons as natural cloning and expression vectors, integrons as mobile gene cassettes and integron mobilization.

CO13. Explain the non-rhizobium PGPRs such as PGPR genera for e.g. Pseudomonas, Serratia, Azotobacter, Azospirillum etc., role of PGPRs in different fields

CO14. Explain the role of various radiations in diagnostics, use of ionizing radiations such as X-ray, CT scans and non-ionizing radiations in MRI and ultrasound scans and use of gamma rays along with their risks.

CO15. Define and explain the principle behind phosphorescence, fluorescence and luminescence, define the terms such as Radioluminescence, chemiluminescence, photoluminescence etc., quantum efficiency, florescence lifetime, triplet state, singlet state and stokes shift, understand the Jablonski diagram. Fluorescence quenching and photobleaching, differentiate between fluorescence and phosphorescence.

CO16. Describe the instrumentation of fluorescence spectroscopy such as types of light sources and its applications such as the use of fluorescent probes, structure elucidation of proteins, studying drug-protein binding, fluorescent detectors in HPLC, FRET, FRAP etc.

CO17. Understand the concept and applications of non-aqueous enzymology, the alternating the properties of enzymes Main strategies to improve enzyme activity/stability or to alter substrate specificity in non-aqueous media by surface modification with amphiphiles, freeze drying from salt containing solutions etc. Applications such as the production of naturally solvent-stable proteases, lipases, cholesterol oxidase other industrially important enzymes, production of pharmaceuticals etc.

M.Sc Microbial Biotechnology (2nd year) Semester 4

MBT-401T: Seminar and Journal Club

At the end of the course, students will be able to:

CO1**: Gain** knowledge about the type of research going on in various countries.

CO2: Give the power point presentation on current topics in the field of Microbiology and Biotechnology

CO3: Give presentation of research papers and learns how to defend a talk.

MBT-402T: Dissertation and Viva

At the end of the course, students will be able to:

CO1: Learn to do literature survey

CO2: Practical skills, handling of lab equipment's, preparation of reagents lab safety measures

CO3: Carry out independent research work

CO4: Compile and interpret scientific data

CO5: Write dissertation

CO6: Give presentation of their scientific findings and learn how to defend them.

DEPARTMENT OF BOTANY

Programme outcome -

After completing B.Sc. students will be able to

PO1 - Demonstrate and apply fundamental knowledge of basic principles of different fields of Biology.

PO2- Apply knowledge for conservation of endemic and endangered plant species.

PO3- Apply knowledge of medicinal and economic importance of plants and their products in day to day life.

PO4- Communicate scientific information in a clear and concise manner both orally and in writing.

PO 5 - Explain biodiversity, climate change and plant pathology with more clarity.

PO6 - Apply ecology, genetics and plant breeding techniques in plant sciences.

PO7 - Apply the knowledge to develop sustainable and ecofriendly technology.

PO8 - Students will have developed their critical reasoning, judgement and communication skills.

PO9- Enhance scientific temper among the students so that to develop a research oriented culture and implementation of policies to tackle the burning issues at global and local level.

Programme specific outcome -

PSO1 - Understand the diversity of plants and their structural organization like Gymnosperms and Angiosperms.

PSO2- Understand plant structures in the context of physiology and biochemical functions of plants.

PSO3- Well versed with various mechanisms and techniques of vegetative propagation and micro propagation.

PSO4 - Learn about economic botany and cultivation practices, can use their knowledge to increase crop yield and minimize waste in agriculture business.

PSO5 - Able to promote values and attitudes towards sustainable environment with minimal harm to ecosystem.

Course Outcome -

1st year B.Sc. Botany

Course I – Foundations of Botany

After successfully completing this one of the basic science courses –

CO1 -Students will be able to comprehend the Diversity of plants starting from Bacteria, Cyanobacteria, Algae, Fungi, Bryophytes and Pteridophytes

CO2 Students will understand the evolution and phylogenetic relations of various taxonomic groups

CO3 Students of Botany will know about the economic importance of Bacteria, Algae, Fungi and Lichens.

CO4 Students learn about various Plant diseases caused by Bacteria and Fungi

Course II – Cell Biology and Genetics

After successfully completing this course, students will be able to –

CO1 – Students would understand structure and functions of cell organelles present in plants.

CO2 – Students will understand basic principles of Heredity and variations and various phenomenon associated with Genetics, mutations and plant breeding.

CO3 – Students will also become familiar with basic processes of molecular biology like DNA replication, Transcription, Translation and DNA repair systems.

Practical I and II –

Students will be able to –

CO1 – Recognize various Genera of Algae Fungi Bryophytes and Pteridophytes and demonstrate the life cycles

CO2 – Identify various diseases caused by Bacteria and Fungi

CO3 – Comprehend basics of Plant breeding principles based on Hereditary, Variations and Mutations

2nd year B.Sc. Botany

Course III – Diversity of Seed Plants and their Structure, Development and Reproduction -I

After successfully completing this course, students will be able to –

CO1- discuss about the characteristics and economic importance of Gymnosperms.

CO2 – differentiate between Gymnosperm and Angiosperms.

CO3 – explain Paleobotany, fossil types, their formation and importance in organic evolution.

CO4 – describe many genera of Gymnosperms like Pinus, Cycas and Ephedra.

CO5 – identify and analyze diversity in plant forms

CO6 – recognize the importance of root, stem and leaf by studying their various types, structure and function.

CO7 – outline structure and importance of flower and its role in reproduction.

CO8 – describe Double Fertilization and its significance.

Course IV – Diversity of Seed Plants and their Structure, Development and Reproduction - II

After successfully completing this course, students will be able to –

CO1 – explain plant nomenclature, International Code of Botanical Nomenclature, taxonomic Ranks, type concept and aims and objectives of plant taxonomy.

CO2 – explain different systems of classification and their importance in organization of Botanical Gardens and Botanical Herbaria.

CO3 – outline floral characteristics, general account and diagnostic features of many families like Liliaceae, Ranunculaceae, Gramineae and Brassicaceae.

CO4 – discuss tissue systems like meristematic, permanent and special tissues.

CO5 – describe internal structure of dicot stem and root, and monocot stem and root.

CO6 – recognize anomalous structures in various angiospermic stems.

CO7 – demonstrate various methods of vegetative propagation, basic techniques and importance and their application in horticulture.

CO8 – explain various types of pollination, advantages and disadvantages, contrivances for self and cross pollination. Also able to explain seeds, seed dormancy and its role in plant propagation.

Practical III and IV –

Students will be able to –

CO1 – demonstrate and analyze external and internal structure of Gymnosperms

CO2 – demonstrate various techniques for preparation of stained slide of root, stem and leaf.

CO3 – identify different modifications of root, stem and leaf.

CO4 – recognize and identify different flowers from their diagnostic floral characteristics.

3rd year B.Sc. Botany

Course V– Plant Physiology-I & Plant Ecology

After successfully completing this course, students will be able to –

CO1- Understand the importance of water in botanical life along with its physiological processes in the plants. Students will also learn mechanisms and theories of water & gas exchanges in plants

CO2 – Explain importance of minerals and the process of their uptake & usage. Also learning various deficiency symptoms of minerals and their manifestation in plants.

CO3 – Learn about nitrogen fixation and role of nitrate reductase and ammonia assimilation as well as functions of lipids and fatty acids in plants

CO4 – Learn classification, role & structure of proteins & enzyme. Also understand mechanism of enzyme action

CO5 – Define ecology and learn about various biotic & abiotic factors affecting growth & distribution of plants

CO6 – Understand various structure of ecosystems, concept of energy flow & biogeochemical cycles of carbon, nitrogen & water

CO7 – Learn qualitative & quantitative characteristics of a community. Differentiate between hydrosere & xerosere

CO8 – Learn about air, water & soil pollutions and awareness about conservations and management of natural resources

Course VI – Plant Physiology – II & Economic Botany

After successfully completing this course, students will be able to –

CO1 – In depth study of photosynthesis from various concepts and cycles that are performed during photosynthesis

CO2 – Learn about aerobic & anaerobic respirations and all its associated cycles in plants

CO3 – Understand phases, kinetics and concepts of growth & development in plants. Learn role of plant hormones & their history

CO4 – Learn basic aspects of plant tissues culture & its applications and somatic hybridization

CO5 – Become aware of area of cultivation, soil requirements, cultivation practices of wheat, rice, maize, cotton & potato

CO6 – Learn area of cultivation, soil requirements, cultivation practices of mango, grapes, lemon, sugarcane, groundnut & mustard

CO7 – Elementary knowledge of basic botanical information regarding moong, gram, timbers, fibers and spices & condiments along with their economic importance

CO8 – Gain knowledge of basic botanical information regarding pupl plants, medicinal plants & beverages along with becoming aware about forest conservation and wood seasoning & its preservation

Practical V and VI –

Students will be able to –

CO1. Demonstrate osmotic pressure of cell sap, imbibitions pressure, osmosis, plasmolysis & deplasmolysis, mechanical & electrical adsorption, transpiration pull, opening & closing of stomata & ascent of sap.

CO2. Identify ecological adaptations in external & internal characters of hydrophytes & xerophytes and determine pH & water holding capacity of soil

CO3. Demonstrate chlorophyll, light, and CO2 is essential of photosynthesis, aerobic & anaerobic respiration, presence of amylase & catalase in plant tissue, phototropism & geotropism and presence of starch, proteins, amino acid & reducing sugars in plants

CO4. Study morphology of some economically important cereals, fibres, fruits, sugar & oil yielding plants

Chemistry

BIOT-Sem-I-IV-T

CO1. Understand the basics of chemistry including chemical bonding, periodic properties, and organic chemistry.
Enhance the understanding of various biological processes which involve chemical reactions.

PG Department of Chemistry Sri Guru Gobind Singh College, Sector 26, Chandigarh

Program Outcome/Program Specific Outcome/Course Outcome:

The PG Department of Chemistry, Sri Guru Gobind Singh College was established with the inception of college in 1966. In the quest of academic excellence, the Department is dedicated in providing the best quality and up-to-date education for students. The Department offers degree programmes at undergraduate and postgraduate level. The department has 5 well-full-fledged laboratories equipped with state-of-art instruments such as UV-Vis Spectrophotometer, conductivity meter, muffle furnace, fuming cupboard, polarimeter etc. required to carry out modern day chemistry. The main objective of the department is to provide a strong foundation in fundamentals of chemistry through course offered by the Panjab University & a comprehensive practical exposure to the various instrumental techniques to the students required for their undergraduate and post graduate programmes. The department encompasses highly competent and well qualified teaching faculty who have the urge to make the students to fly with colours. Besides teaching, faculty has active, DST and UGC funded research projects that stretch this traditional structure to cover an exciting array of interdisciplinary research. Various faculty members have made significant contributions and have published many research papers in reputed peer reviewed Journals. At the chemistry department we wish to provide our students the best possible learning environment to help them identify their career objectives, to express, organize, and implement their ideas individually as well as collectively.

The Department has formulated three broad educational goals for the undergraduate degree programs:

Chemistry knowledge: To provide students with the basic foundation in Chemistry and allied subjects, the interplay of theory and experiment, and to motivate scientific enthusiasm and curiosity and the joy of learning.

Problem solving skills: To provide students with the tools needed to analyse problems with the skills required to succeed in graduate school, the chemical industry or professional school.

Employment and technical skills: To provide the students with technical skills necessary for successful careers in chemistry and related or alternative careers for which a chemistry foundation can be very useful. These include to a breadth of experimental techniques using modern instrumentation and communication skills (oral and written).

Program Outcomes

Knowledge outcome:

After completing B.Sc. Chemistry Programme students will be able to:

PO1: Transfer and apply the acquired fundamental knowledge of chemistry, including basic concepts and principles of 1) organic chemistry, Inorganic chemistry, Physical and Analytical Chemistry; (2) analytic techniques and experimental methods for chemistry to study different branches of chemistry;

PO2: Demonstrate the ability to explain the importance of the Periodic Table of the Elements and represent key aspects of it and its role in organizing chemical information. Skills Outcomes Professional Skills After completing B.Sc. Physics Programme students will be able to:

PO3: apply and demonstrate knowledge of essential facts, concepts, laws, principles and theories related to chemistry;

PO4: demonstrate the learned laboratory skills, enabling them to perform qualitative and quantitative analysis of given samples and able to make conclusions on it;

PO5: set procedure and synthesize simple compounds of commercial importance;

PO7: engage in oral and written scientific communication, and will prove that they can think critically and work independently.

PO8: Communicate effectively using graphical techniques, reports and presentations within a scientific environment.

PO9: to recognize problems in chemical science and make strategies to solve it. **PO8:** Respond effectively to unfamiliar problems in scientific contexts

PO10: Plan, execute of design experiment, make documentation of it, interpret data at entry level of chemical industry and report the results;

PO11: Integrate and apply these skills to study different branches of chemistry. Generic Competencies

PO12: The student will acquire knowledge effectively by self-study and work independently, present information in a clear, concise and logical manner and apply appropriate analytical and approximation methods.

PO13: The student will learn professionalism, including the ability to work in groups and in society, and apply basic ethical principles.

Program Specific Outcomes

After completing B. Sc. Chemistry, students will be able to

PSO1: Understand the nature and basic concepts of Physical, Organic and Inorganic chemistry;

PSO2: Analyze Organic and inorganic compounds qualitatively and quantitatively;

PSO3: Understand the applications of physical, organic, inorganic and analytical chemistry in pharmaceutical, agriculture and chemical industries;

PSO4: Able to perform experimental procedures as per laboratory manual in the area of physical, Inorganic and organic chemistry;

PSO5: interpretation and synthesis of chemical information and data obtained from chemical and instrumental analysis

Course Outcome: **Under-graduate Program**:

Semester-1

Paper A-Inorganic Chemistry:

At the end of course students will be able to:

CO1.

- Understand the behaviour and interactions between matter and energy at both the atomic and molecular level.
- To learn the trends in periodic properties and applications in predicting and explaining the chemical behaviour of s-block elements and noble gasses.
- To understand that the material world around can be understood from the perspective of the periodic properties.

Paper B-Organic Chemistry:

By the end of this course students will able to CO1.

- Understand the basic concepts and mechanism in organic chemistry.
- Get an introductory lesson for the various kinetic and thermodynamic factors which control the organic reactions.
- Know the stereochemistry and various possible conformations of organic compounds and their effect on the chemical reactions.
- Understand the role of various reaction intermediates like carbanion, carbocation, carbenes, radicals etc. in organic reactions.
- Get familiar with alkanes and cycloalkanes.
- Write the structures of constitutional isomers of alkanes and understand the physical and chemical properties of alkanes.

Paper C- Physical Chemistry:

At the end of course student will able to

CO1.

- Comprehend the knowledge regarding mathematical concepts like mean, median, differentiation and integration and evaluation of analytical data.

- Develop a comprehensive knowledge of kinetic theory of gases.
- Learn the various theories of chemical kinetics, its scope, rate and order of reaction and kinetics of chemical reactions.
- Gain knowledge about catalysis and general characteristics of catalytic reaction.

Laboratory Practical:

- At the end of this course students will be able to do the systematically qualitative analysis of analysis mixtures containing two acid and two basic radicals with interfering radical.
- The students will get skill in the quantitative analysis by doing titrations in the different branches of volumetric analysis

Semester-II

Paper A-Inorganic Chemistry:

At the end of course students will be able to:

CO1.

- Predict atomic structure, chemical bonding and molecular geometry based on accepted models.
- Get an idea of comparative study of p-Block elements, their basic properties and compounds formed.
- Get familiar with the various reactions and formation of different compounds by p-bock elements.

Paper B-Organic Chemistry:

At the end of course students will be able to:

CO1.

- Understand the basic concepts and mechanism in organic chemistry.
- Get a thorough knowledge about the chemistry of some selected functional groups with a view to develop proper aptitude towards the study of organic compounds and their reactions.
- Understand and study organic reaction mechanisms.
- Understand the concept of aromaticity.
- Get an introduction to arenes and general pattern of aromatic electrophilic substitution reactions in them and their mechanism.

Paper C- Physical Chemistry:

At the end of course student will able to

CO1.

- Get an insight of the thermal chemistry.
- Describe the laws of thermodynamics and get the ability to understand the thermodynamic terms and processes.
- Calculate the various thermodynamic functions under different conditions from the thermo-chemical data available.
- Learn various colloidal states of the matter.
- Describe the concept of colloidal material, classification, synthesis and their stability for many practical uses and information on colligative properties

Laboratory Practical:

CO1. The students will develop basic skills in the techniques of crystallisation and melting point determination.

CO2. Determine the physical properties like surface tension, viscosity and refractive index of liquids.

Semester-III

Paper A-Inorganic Chemistry:

At the end of course student will able to

CO1.

- Get the knowledge regarding fundamentals of coordination chemistry.
- Get an idea of coordination chemistry starting with the concept of Werner's coordination theory help the students to step into the vast realm of complex compounds.
- Learn about the behaviour of transition and inner transition elements.
- Build a strong foundation of d-block elements and better understanding of their reactivity and compounds formed by them.

Paper B-Organic Chemistry:

At the end of course student will able to

CO1.

- Understand the basic concepts and mechanism in organic chemistry.
- Learn the physical and chemical properties of common functional groups.
- Get an insight to the kinetic aspects of chemical reactions, nomenclature and classification of organic compounds and named organic reactions.
- Know about the organic compounds of nitrogen, structure and nomenclature of amines, their physical properties and stereochemistry.
- Learn the method to separate a mixture of primary, secondary and tertiary amines.
- Understand the structural features effecting basicity of amines.

Paper C- Physical Chemistry:

At the end of course student will able to

CO1.

- Understand the general characteristics of different states of matter.
- Describe the difference between intermolecular forces in gases and liquids, difference between liquid crystal, solid and liquid.
- Get an insight of various laws of thermodynamics.
- Learn the concept of entropy, Gibbs and Helmholtz functions and their advantage over entropy.

Laboratory Practical:

CO1. The students will get training in the quantitative analysis of metal ions and anions using gravimetric method.

CO2. The students will get skill in the quantitative analysis by doing titrations in the different branches of volumetric analysis.

CO3. Determine the heat of neutralisation and solubility.

Semester-IV

Paper A-Inorganic Chemistry:

At the end of course student will able to

CO1.

- Learn about the behaviour of f-block elements, understand the lanthanide contraction and compare d and f-block elements.
- Get an idea of acids and bases help students identify various compounds in term of acids and bases and also to compare their relative strength.
- Get familiar with the basic knowledge of the non-aqueous solutions and applications of non-aqueous solvents in chemistry.
- Learning of redox potential and redox equilibria helps the students to explain the reactions in term of oxidation and reduction.
- To know about various EMF diagrams act as important tool to explain various chemical phenomenon.

Paper B-Organic Chemistry:

At the end of course student will able to

CO1.

- Understand the basic concepts and mechanism in organic chemistry. Learn the physical and chemical properties of common functional groups.

- Get an insight to the chemical reactions, nomenclature and classification of oils and fats, soaps and detergents.
- Check the purity of oils and fats.
- Know about molecular orbital picture and aromatic character heterocyclic compounds in this course.
- Understand the methods of their synthesis and various mechanisms involved and able to compare the basicity of different compounds.

Paper C- Physical Chemistry:

At the end of course student will able to

CO1.

- Describes basic concepts of Thermodynamics, restate definition of various laws of thermodynamics, extensive and intensive properties.
- Calculate changes in kinetic, potential, enthalpy and internal energy.
- Understand difference between voltaic/galvanic and electrolytic electrochemical cells. Write balanced half and overall cell reactions.
- Calculate the standard reduction potential and understand the relationship between Gibbs free energy, electromotive force, enthalpy, entropy change and equilibrium constant.

Laboratory Practical:

CO1. This laboratory course gives students training for systematic qualitative analysis of organic compounds.

CO2. The students develop the skill to extract caffeine from tea leaves.

CO3. Perform acid base titration using PH metre.

CO4. Perform Thin Layer Chromatography and identify the compound from Rf value.

Semester-V

Paper A-Inorganic Chemistry:

At the end of course student will able to

CO1.

- Impart knowledge regarding metal-ligand bonding in transition metal complexes.
- Get an insight of organometallic chemistry, nomenclature and classification of organometallic compounds.
- Know the preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn andTi.
- Understand the nature of bonding in metal carbonyls.
- Know the presence of essential and trace elements in biological processes,

metalloporphyrins with special reference to hemoglobin and myoglobin.

- To learn bioinorganic chemistry which helps the students to understand the role of alkali and alkaline metal ions in biological systems.

Paper B-Organic Chemistry:

At the end of course student will able to

CO1.

- Get in depth and practical knowledge of IR, UV and NMR spectroscopy.
- Describe the basic principles of various spectroscopic techniques and relate the techniques to applications in organic chemistry.
- Elucidate the structure of compounds by analysing the spectral data.
- Get a brief introduction of one of the major class of biomolecules (i.e. Carbohydrates).
- Differentiate monosaccharides, disaccharides and polysaccharides.
- Describe the structure and functions of carbohydrates.
- Determine ring size of monosaccharides and understand the mechanism of mutarotation.

Paper C- Physical Chemistry:

At the end of course student will able to

CO1.

- Learn the fundamentals of quantum mechanics and its applications in the study of structure of atoms, bonding in molecules.
- Understand Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, and particle in a one-dimensional box.
- Get an introduction of valence bond model of H2, comparison of M.O. and V.B. models.
- Build a strong foundation of photochemistry and better understanding of fluorescence, phosphorescence, non-radiative processes, quantum yield, photosensitized reactions, Photochemistry of carbonyl compounds and alkenes.
- Apprise with various laws of photochemistry.

Laboratory Practical:

CO1. Enable the students in Organic preparations.

CO2. In this course the student will have an introductory concept of conductometry.

CO3. Determine the distribution coefficient.

CO4. Determine the molecular weight by Rast Method

Semester-VI

Paper A-Inorganic Chemistry:

At the end of course student will able to

CO1.

- Impart information on inorganic polymers and nature of bonding in them.
- Get an introduction to concepts of hard and soft bases, acid-base strength Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.
- Develop the understanding about electronic spectra of complex ions.
- Understand the magnetic properties of transition metal complexes, methods of determining magnetic susceptibility and application of magnetic moment data for 3d metal complexes.

Paper B-Organic Chemistry:

At the end of course student will able to

CO1.

- Understand some fundamental aspects of organic chemistry.
- Learn mechanism of some organic reactions, classification of polymers, structure and uses of some commercial and natural polymers.
- Know about the classification, structure and stereochemistry of amino acids, proteins and nucleic acids.
- Draw the structures of peptides and proteins.
- Understand the phenomenon of Protein denaturation/renaturation.
- Understand the formation, structure and applicability of organometallic compounds.

Paper C- Physical Chemistry:

At the end of course student will able to

CO1.

- Impart a thorough knowledge of the fundamentals of microwave, infra-red, Raman, electronic spectrometry.
- Know about the interactions of electromagnetic radiation and matter and their applications in spectroscopy.
- Get an introduction to the laws of crystallography.
- Determine the crystal structure and understand the thermal and photochemical reactions in solid state.

Laboratory Practical:

CO1. The students will develop basic skills in the techniques of crystallisation, distillation, solvent extraction, TLC and column chromatography. Enable the students in Organic preparations

Programme Specific Outcome Postgraduate Programme: After completionof this programme the Students will have

PO1. In-depth and detailed functional knowledge of the fundamental theoretical concepts and experimental methods of chemistry.

PO2. Ability to take up Global level research opportunities to pursue Ph.D. programme and the student will be more resourceful and will have targeted approach to qualify competitive examinations.

PO3. With the knowledge of chemistry, they can get employment in chemical, pharmaceutical, food and material industries.

PO4. After passing this programme the student will be having the capability to think and teach aspects of chemistry to the different levels of students in a futuristic manner.

Course Outcome: **Post-graduate Program**:

Semester- I

Inorganic Chemistry: Paper-I (CH-411)

At the end of the course, the students will be able to

CO1.

- Know about the stereochemistry and metal ligand bonding in octahedral, tetrahedral and square planar complexes of main group compounds.
- Learn the VSEPR, π-bonding and molecular orbital theory, limitations of crystal field and molecular orbital theory.

CO2.

- Learn the various aspects of transition metal complexes like energy profile, kinetics, mechanism of substitution reactions (acid hydrolysis, base hydrolysis and conjugate base mechanism).
- Know the Factors affecting mechanism, evidences in favour of mechanism, and kinetic application of valence bond & crystal field theories.

Organic Chemistry: Paper-II(CH-412)

At the end of the course, the students will be able to

CO1.

- Review some fundamental concepts of chemical structure and bonding in the organic molecules, understand the structure activity relationship.
- Get familiar with bonds weaker than covalent bond and their significance in addition compounds.
- Learn HMO and PMO theories, using them they will be able to construct the molecular orbitals and hence explain the aromaticity of benzenoid and non- benzenoid compounds.

- Understand Curtin-Hammett Principle and Hammond's Postulate.

CO2.

- Get an introduction to the dynamic stereochemistry.
- Learn the stereochemical aspects of different reactions.
- Identify and differentiate between prochirality and chirality at centres, axis, planes and helices and to determine the absolute configuration.
- Evaluate the stability of various conformers of acyclic and cyclic systems using steric, electronic and stereo electronic effects and correlate them to reactivity.

CO3.

- Learn the chemical reactions including Aliphatic and Aromatic electrophilic and nucleophilic substitution.
- Understand the formation of classical and non-classical carbocations.
- Get acquainted with SN1, SN2 SET, SE2 and SE1 mechanisms.
- Develop the thinking skills related to organic reaction mechanisms and get familiar with the reaction conditions to enhance the reactivity through this course.
- Gain in-depth knowledge of some fundamental concepts such as neighbouring group participation, ortho/para ratio, ipso attack etc.

Physical Chemistry: Paper-III(CH-413)

At the end of the course, the students will be able to

CO1.

Know the fundamental principles of Physical Chemistry. The advanced topics given in the given syllabus give in-depth study of Chemistry.

CO2.

Know the fundamentals of Quantum Chemistry which deals with the world of very small. It results in what may appear to be some very strange conclusions about the physical world. It relies heavily on spectroscopy which help students to understand quantization of energy on a molecular scale.

CO3.

- Learn about the angular momentum and molecular orbital theory which help students to understand the stability of various molecules.
- Understand the condition of Bond order which explains why some molecules exist while other don't.

CO4.

- Learn the Classical Thermodynamics and Statistical Thermodynamics deals with heat, temperature, energy, work and properties of matter.
- Know different laws in Thermodynamics give the real picture of the universe.
- Explains the spontaneity of various physical and chemical processes in term of entropy and energy.

Biology for Chemists: Paper-IV(CH-414)

At the end of the course, the students will be able to

CO1. Know the basics of metabolic process in all living organism.

CO2.Understand various pathways like ATP, role of various enzymes, role of amino acids, and proteins.

CO3. Explain DNA structure, transfer of genetic information from one generation to another generation, disorders etc.

CO4. Understand the complexity of biological reactions in living organism.

CO5.Lean that bioactive Compounds are essential part of human life.

CO6. Get an idea of role of these compounds, their biosynthesis, advantage and disadvantages in living organism.

Mathematics for Chemists: Paper-IV (CH-414)

At the end of the course, the students will be able to CO1.

CO1.Learn working with vector calculus and matrix algebra.

CO2.Know about the concept of elementary differential equation and their application in chemical kinetics, quantum mechanics etc.

CO3.Solve differential equations by different methods.

CO4.Describe the application of differential calculus and attain skills to draw curves.

CO5.Learn about the concept of probability which is practically used in kinetic theory of gases. Student will able to draw curve fitting with a general polynomial fit.

Computers for Chemists: Paper-IV (CH-414)

At the end of the course, the students will be able to

CO1. Learn how to run standard programmes and software.

CO2.Develop codes using simple formula in chemistry such as Kinetics pH titration, radioactive decay ionic radii from experimental data.

CO3.Understand elements of computer language, constants, variables operators and symbols etc.

Laboratory course (Inorganic chemistry): Paper-V (CH-415)

CO1. Students become able to estimate volumetrically (complexometry) the metal content in a binary mixture like Fe+ Ni, Fe+Co, Fe+Cu, Ni+Co, Ni+Mn etc.

CO2. They also acquire the skills of Gravimetric analysis metal ions in binary mixture.

Laboratory course (Organic chemistry): Paper-VI (CH-416)

CO1. Independently perform two or more step organic synthesis.

CO2. Identify the synthesized compounds by M. Pt determination and purify it by recrystallization.

CO3. Predict the outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups.

CO4. Hence, they will learn and apply basic techniques used in the organic laboratory for preparation, purification and identification of organic compounds.

Laboratory course (Physical chemistry): Paper-VI (CH-417)

CO1. The molecular weight of polymers and Viscosity of liquid mixtures by viscosity. Measurement

CO2. Determine the critical micelle concentration of soap and compare the cleansing power of detergents by surface tension methods

CO3. Determine the solubility and solubility product of various salts at different temperature hence gain the ability to draw the solubility curve.

CO4. Determine the partial molar volume of liquid from the density data.

Semester- II

Inorganic Chemistry: Paper-I (CH-421)

At the end of the course, the students will be able to.

CO1. Build a strong foundation on electronic & charge transfer spectra, spectroscopic ground states, magnetic properties and anomalous magnetic moments of transition metal complexes.

CO2. Gain information regarding stereochemistry and method of assignment of absolute configuration in optically active metal chelates.

CO3. Learn about various preparation methods, structure, bonding and important reactions of Metal π-Complexs including transition metal carbonyls, nitrosyls, dinitrogen and dioxygen complexes.

CO4. Use vibrational spectra of metal carbonyls for bonding and structure elucidation.

CO5.Learn the Metal Cluster of higher boranes, carboranes, metalloboranes, metallocarboranes, halide clusters and compounds with metal-metal multiple bonds.

Organic Chemistry: Paper-II (CH-422):

At the end of the course, the students will be able to

CO1.

- Learn Pericyclic reaction: Electro cyclic, Cycloaddition, and Ene Reaction, Sigma tropic shifts and their analysis by correlation diagram, FMO approach and ATS concept.
- Predict the product due to photochemical and thermal reaction mechanism.
- Acquire knowledge of Molecular orbital symmetry and possibility of thermally and photochemically pericyclic reactions.

CO2.

Develop an ability to understand addition and elimination reactions with mechanism and stereochemical aspect Reaction conditions, products formation and mechanisms of some named reactions and addition to C=O bonds.

CO3.

- Predict the outcome for the different types of electrophilic addition reactions to alkene and stereochemistry of products arising from these reactions using reaction mechanisms and stability of react ion intermediates to stereochemical outcome of syn and anti-addition.
- Classify addition reactions to alkenes as regioselective or stereoselective.

- Understand the Free radical addition, substitution and rearrangement reactions.
- Learn about the mechanism of these reactions.
- Know about the solvents effect reactivity of molecules.
- Discuss Barton, Sandmeyer and Ullmann reaction mechanism using free radical pathway.

Physical Chemistry: Paper-III (CH-423)

At the end of the course, the students will be able to

CO1.

- Get the knowledge of dynamics and speed of different reactions.
- Learn about chemistry of reactions in organic chemistry but physical chemistry helps the students to know why different reactions moves with different speeds.

CO2.

- Learn about the reactions going in the biological system.
- Get knowledge about Non-equilibrium thermodynamics which helps to differentiate physical systems from biological systems as biological processes accomplished with low entropies.

CO3.

Advance the topics like macromolecules help the student to understand the synthesis and applications of polymers in our daily life.

CO4.

- Electrochemistry covered in this section give wide range of technological applications.
- Understand the batteries, cells, Uses of liquid crystals in daily electronic devices.
- Understand the concept of corrosion and current in the electrochemical and electrolytical cells.

Group Theory and Spectroscopy: Paper-IV (CH-424)

At the end of the course, the students will be able to

CO1. Acquire qualitative and quantitative knowledge of the fundamental concepts of various spectroscopic methods, group theoretical concepts and diffraction techniques, and their applications to characterize different molecules and crystals.

CO2. Distinguish between various spectroscopic transitions and interpret data for molecular characterization.

Laboratory course (Inorganic chemistry): Paper-V (CH-425)

CO1. This this laboratory course, students familiarize with synthesis methods of transition metal coordination compounds with cobalt, copper and chromium with different ligands.

CO2. They also interpret the electronic spectra and study the magnetic properties of the synthesized complexes.

Laboratory course (Organic chemistry): Paper-VI (CH-426)

CO1. This laboratory course gives students training for separation and systematic qualitative analysis of mixture of organic compounds.

CO2. They will also gain an understanding of methods related to chemical analysis such as preliminary tests, detection of elements, functional groups, their confirmation and M. Ptdetermination.

Laboratory course (Physical chemistry): Paper-VI (CH-427)

CO1. The students will acquire the skills of Polarimetry, Potentiometry and Flame photometry in this course.

CO2. Performing experiments in the lab they acquire the skills to determine optical activity, equilibrium constants, thermodynamic functions, hydrolysis constants and determination of cations present together.

Semester- III

Applications of spectroscopy: Paper-I (CH-511)

At the end of the course, the students will be able to.

CO1. Learn the various types of spectroscopic technique such as, electron spin resonance (ESR) and nuclear magnetic resonance (NMR) of paramagnetic solutions, Mossbauer, Vibrational, Ultraviolet and Visible, Infrared Nuclear Magnetic Resonance (proton and Carbon-13) Spectroscopy and Mass Spectrometry.

CO2. Know different types of spectroscopy. They also learn to solve the structural problems with spectral datainformation.

Organo-Transition Metal Chemistry: Paper-II (CH-512)

At the end of the course, the students will be able to CO1.

CO1. Use the basic principles of descriptive chemistry and molecular orbital theory to describe chemical bonding and structure of organo transition metal compounds.

CO2. Explain and predict the chemical behaviour and reactivity of these compounds and their role in organic synthesis. Get familiar with transition metal compounds with bonds to hydrogen.

CO3. Understand the fluxionality and dynamic equilibrium in compounds such as dienyl complexes Describe and explain catalytic processes using an organometallic compound as a catalyst.

CO4. Show and explain how organo transition metal compounds are used as catalysts in organic synthesis.

CO5. Describe stoichiometric reaction for catalysis, homolytic catalytic hydrogenation, oxopalladation reaction and activation of C-H bond.

Heterocyclic: Paper-III (CH-513)

At the end of the course, the students will be able to.

CO1. Know the fundamental theoretical understanding of heterocyclic chemistry, including alternative general methods for ring synthesis and application of such methods for the preparation of specific groups of heterocyclic systems.

CO2. Get familiar with particular properties and reactions for the most important heterocycles as well as different systems of nomenclature.

CO3. Understand the importance of heterocycles in biological systems and in pharmaceuticals.

CO4. Draw mechanisms for reactions involving heterocycles as starting materials, intermediates and products, and be able to propose syntheses of heterocycles from the major classes.

Environmental Chemistry: Paper-IV (CH-514)

Upon successful completion of the course the student will be able to:

CO1. Understand from the fundamental concepts of environment to various chemical solutions to environmental problems. Recognize industrial pollution due to cement, sugar, drug, polymers, metallurgy, paper industry etc. and their ways of management in terms of better industrial processes.

CO2. Describe various disasters like Bhopal gas tragedy, Chernobyl, Sevoso, Threemile island, Minamata and future preventions.

CO3. Explain different pollutions like soil and water covering important aspects like BOD, COD, DO and residualchlorine.

CO4. Discuss the most prevalent local and global environmental issues like global warming, greenhouse effect, ozone depletion, chloro fluoro hydrocarbons etc. and apply to current areas of research based on the knowledge gained throughout the course.

Laboratory course (Inorganic chemistry): Paper-V (CH-515)

Upon successful completion of the course the student will be able to:

CO1. After performing colorimetric estimation of cations and anions, the students acquire the skill to analyse and implement spectrometric data to verify Lambert-Beers Law and Law of continuous variation (Job's Method).

CO2. They also use various chromatographic techniques like paper, column and ion exchange for separation and purification of mixture of ions.

CO3. They also develop separation technique by using solvent extraction method for separation of mixture of ions.

Laboratory course (Organic chemistry): Paper-VI (CH-516)

CO1. Students learn the synthesis of various organic compounds based upon oxidation, reduction reactions, photo catalysed reaction, radical coupling reactions and rearrangements.

CO2. They also acquire the knowledge about how to monitor the reactions and what happens when the reactions conditions arevaried.

Laboratory course (Physical chemistry): Paper-VII (CH-517)

CO1. In this course the student will have an introductory concept of conductometry, chemical Kinetics and phase equilibrium.

CO2. The students gain the ability to determine Cell constant, equivalent conductance, its variation `with dilution, degree of dissociation, titration of mixtures etc. conduct ometrically. Compare the strength of two acids and study the kinetics of reaction.

CO3. Determine the critical solution temperatures of binary liquid mixtures and able to draw the phase diagram at different compositions.

Semester- IV

Biophysical Chemistry: Paper-I (CH-521)

Upon successful completion of the course the student will be able to:

CO1. Upon completion of the course students will be able to understand the concepts of physics and physical chemistry for studying the biological systems. This will be an aid for the chemist who aims to imitate the biological systems.

CO2. Students will learn the basic considerations about the biological cell and enzymes which are generally organic catalysts.

CO3. This course also provides in depth mechanism of enzyme action and types of reactions which are catalysed by the enzymes.

CO4. Co-enzyme Chemistry section of course will provide the understanding that how non-protein organic factors assist enzymes in the biological reactions.

Organic Synthesis: Paper-II (CH-522)

Upon successful completion of the course the student will be able to:.

CO1. Use the basic principles of descriptive chemistry and molecular orbital theory to describe chemical bonding and structure of organometallic compounds.

CO2. Explain and predict the chemical behaviour and reactivity of organometallic compounds.
CO3. Describe and explain regioselectivity, chemo selectivity and diastereoselectivity.

CO4. Show and explain how organometallic compounds are used in organic synthesis.

CO5. Describe physical characterization methods used to study the structure and behaviour of organometallic compounds.

CO6. They are introduced to different oxidative and reductive processes of various functional groups and their derivatives. By studying name reactions, they gain knowledge about the general mechanism and nature of migration in these reactions.

Chemistry of natural products: Paper-III (CH-523)

Upon successful completion of the course the student will be able to:

CO1. Perform the structure elucidation and synthesis of some common terpenoids, carotenoids, alkaloids, steroids and plant pigments.

CO2. Gain basic knowledge and the synthesis of common porphyrins, prostaglandins, pyrethroids and rotenones.

CO3. Learn the approach for the structure elucidation of unknown compounds using structure elucidation of some natural products.

CO4. Know the practical applications of all the chemical reactions after studying the complete synthesis of natural molecules.

Photochemistry and Solid state: Paper-IV (CH-524)

Photochemistry

Upon successful completion of the course the student will be able to:

CO1.

- Learn the laws of photochemistry and the interaction of electromagnetic radiation with matter, types of excitation and fate of photoexcited molecule.
- Learn the methods for standardization of photodetectors in actinometry used to determine quantum yield of photochemical reactions.
- Determine rate of photochemical reactions and discuss the effect of intensity of light on these reactions.

CO2.

Basics of intermolecular and intramolecular photochemical reactions of alkenes, carbonyl, and aromatic compounds are also discussed in this section

CO3.

- Apply the photochemistry concepts, plan and program molecules for photochemical application of specific interest.
- Appreciate the photochemical phenomena by light and be able to design and practically carry out simple photochemical reactions.
- Demonstrate a sound knowledge of the photochemistry principles and their applications.

Solid State

CO1. Get the knowledge of solid-state chemistry is quite helpful in developing and designing new materials. Learn the crystal structure and its relationship to the properties and their general considerations and experimental procedures towards the solid-state reactions.

CO2. Know the stoichiometric and non-stoichiometric defects, electronic, magnetic and optical

properties of solids will enable students to exploit the various industrial applications of solid materials and also in the designing of new materials with improved properties.

CO3. Students will obtain the knowledge of organic charge transfer complexes acting as the superconducting materials.

Laboratory course Inorganic chemistry): Paper-VI (CH-525)

CO1. Performing practical classes, students will acquire skill of volumetric and amperometric estimation of chemical components using various redox titrations which include dichromatometry, iodometry and iodimetry.

CO2. Students also perform experiments for the analysis of water including hardness, different type of nitrogen (nitrate and ammonium ions), oxygen (BOD/COD) and residual chlorine.

Laboratory course (Organic chemistry): Paper-VI (CH-526)

CO1. Students learn the extraction of some important molecules from natural sources such as caffeine from tea leaves, casein and lactose from milk, lycopene from tomatoes, and hippuric acid from urine.

CO2. Apart from that they also learn the estimation of glucose, sucrose, formaldehyde, glycine and the saponification & iodine values of oils and fats.

Laboratory course (Physical chemistry): Paper-VI (CH-526)

CO1. In this course various aspects of analytical chemistry such as spectrophotometric analysis, chromatography, colorimetry and refractometry acquired by the students.

CO2. Ability to plot a polarogram of mixed solutions from the current-potential data. Students will gain the knowledge of elementary computer programming and get the ability to solve the interactive equations and thus plot the time series.

DEPARTMENT OF COMMERCE

Goals of the department

1. The department intends to inculcate academic honesty among the students which is the primary goal of education.

2. Apart from that, the department aims to make every effort for all round development of the students by encouraging their participation in NSS, NCC, cultural and co-curricular activities

3. The department also focuses on imparting practical knowledge and training to the students in all commerce related areas by organising workshops and seminars

4. The department runs Bachelor and Master in Commerce but it aims to successfully coordinate with other departments for enhancing and facilitating learning in multidisciplinary subjects in the course curriculum

BACHELOR OF COMMERCE

Program Outcomes:

PO 1: B.Com is commerce and finance focused curriculum and offer a number of specializations and practical exposures which would equip the student to face the modern-day challenges in commerce and business.

PO 2: The all-inclusive outlook of the course offers a number of value- based and job-oriented courses and ensures that students are trained and have updated knowledge with regard to these courses

PO 3: The degree is structured to provide the students with managerial skills in disciplines related to commerce, business, marketing, accounting, economics, finance etc.

PO 4: The course aims to develop entrepreneurial and employability skills among students

PO 5: Overall, the course aims to help the students in gaining knowledge, practically applying that knowledge to acquire skills, becoming self-reliant and work for own and society's benefit

Program Specific Outcomes:

PSO 1: The student studies accounting course beyond the introductory level in B.Com curriculum, so can become successful chartered accountant
PSO 2: The curriculum involves many management related subjects which enhance the managerial skills of the students and enable them to be successful managers

PSO 3: Students gain an in-depth knowledge on commercial, company and tax laws hence, can pursue these professions

PSO 4: Students are well prepared to start own venture as an entrepreneur

PSO 5: Students will have adequate knowledge of changes in the flexible business world and an in-depth understanding of the business world's market-relevant aspects, hence can focus on international opportunities

PSO 6: Students get complete knowledge of banking and insurance and related aspects, hence, can successfully enter into these fields

PSO 7: The students can also further explore and excel into the areas of auditing and portfolio management security analysis and can practice as market analyst and auditors

Course Outcomes:

BCOM 1st Semester

Course BCM 103: Psychology for Managers

The following are the learning outcomes of the paper:

CO 1: It acquaints students with the organisational and individual behaviour models which will help them developing into a better personality

CO 2: Helps students in learning about basic human values and attitude

CO 3: It provides an overview of motivation and leadership theories to equip the students to manage the behavioural aspects of business and improving the overall organizational effectiveness

CO 4: It also elaborates the concept of conflict as well as stress management which will help students handle stress and conflict in real life

Course BCM 105: Principles of Financial Accounting

After completing this paper, the students will be in a position to

CO 1: Learn basic accounting concept and standards

CO 2: Make and read financial statements of firms as well as branches

CO 3: Gain knowledge of consignment accounts as well as joint ventures

CO 4: Know about the procedure of dissolution of firm and insolvency of partners

Course BCM 106: Commercial Law

After studying this paper, the students will be in a position to

CO 1: Learn basic provisions of Contract Act with specific reference to Quasi Contracts and Agency Contracts

CO 2: Get knowledge of Right to Information Act

CO 3: Gain insight into The Consumer Protection Act and Grievance Redressal Machinery

Course BCM 107: Principles and Practices of Management

The following are the learning outcomes of the paper:

CO 1: It acquaints students with the terms, concepts, and points of view used in management and its historical evolution.

CO 2: This subject helps students by providing working knowledge of the skills and functions necessary to be an effective and efficient manager.

CO 3: It provides an introduction to the theory and practice of managing organizations.

CO 4: It also elaborates the management functions (planning, organizing, directing, coordinating and controlling) and the impact of those functions on the business organization.

B.COM 2nd Semester

Course BCM 203: E- Commerce

The following are the learning outcomes of the paper:

CO 1: It provides fundamental knowledge about e-commerce, its framework, history and its basic tools.

CO 2: It provides information about the impact of e-commerce on various business sectors along with its socio-economic impact.

CO 3: It also explores the various electronic payment systems alongside with the security issues concerned with electronic data interchange.

CO 4: On the whole it helps the students to perform better in any area of operations and helps them to excel in the field of commerce with IT specialization.

Course BCM 205: Corporate Accounting

After studying this paper, the students will be in a position to

CO 1: Learn accounting treatment of issue, forfeiture, reissue and buy-back of shares

CO 2: Make and read financial statements of companies

CO 3: Gain knowledge of right shares, bonus shares and preference share along with accounting treatment

CO 4: Learn about how to prepare accounts of banking and insurance companies which will enable them to pursue careers accordingly

Course BCM 206: Business Laws

After the study of this paper, the students will be in a position to

CO 1: Learn basic provisions relating to contract of sale along with warranties and conditions contained in Sale of Goods Act, 1930

CO 2: Get knowledge about negotiable instruments and how to handle the issuance and dishonour of these instruments

CO 3: Understand provisions of Factories Act, 1948 with specific reference to approval; licensing & registration of factories, the inspecting staff health; safety welfare; working hours of adults; employment of women; child labour

CO 4: Gain insight into provisions of The Industrial Disputes Act

Course BCM 207: Human Resource Management

After doing this paper students will be in a position to:

CO 1: Know about significance of human resources and its management

CO 2: Learn about recruitment selection and training procedures being followed in corporate sector

CO 3: Understand the performance appraisal techniques and its significance for overall effectiveness of organisation

CO 4: Critically analyse the methods of wage payment being followed in corporations

BCOM 3rd Semester

Course BCM 301: Issues in Indian Commerce

The following is the learning outcome of the paper:

CO 1: It enables the students to have basic knowledge of different issues faced in progress and prospects of commerce in India.

CO 2: It acquaints students with concepts of Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI)

CO 3: It throws light on “Make in India” An Initiative of Government of India

CO 4: It highlights the importance of external sources of finance-External Commercial (FCCBs) Borrowings (ECB), American Depository Receipt (ADR), Global Depository Receipt (GDR)

CO 5: It also helps students to learn about infrastructure development in India with specific reference to models of infrastructure development

CO 6: Students also gain knowledge of Investor Protection and Corporate Scams and Regulatory Authorities

Course BCM 302: Cost Accounting

The course content will enable the students:

CO 1: To understand the meaning and scope of Cost Accounting

CO 2: To prepare the Cost Sheet and calculate the cost of manufacturing firms

CO 3: To understand different components of cost, i.e, material, labour and overheads

CO 4: To understand how they can control cost by controlling material, labour and overheads costs

CO 5: To understand Service Costing, which is applicable to the undertakings which do not manufacture any product but provide services

CO 6: To reconcile the cost Accounting profit with financial profit

CO 7: To understand the concept of Integral and Non-Integral accounts

Course BCM 303: Company Law

The course content will enable the students:

CO 1: To understand the meaning, characteristics and types of companies

CO 2: To learn about the procedure of formation of company

CO 3: To know about basic documents relating to company viz, Memorandum of Association, Articles of Association and Prospectus

CO 4: To gain knowledge of latest concepts like book building and buyback of shares

CO 5: To have comprehensive knowledge of directors, their rights and duties, their powers and liabilities and

CO 6: To get complete understanding of the winding up procedure of the company

Course BCM 305: Banking and Insurance

The course content will provide the students:

CO 1: An understanding about the Indian banking system

CO 2: Knowledge about the reforms in Indian banking system over the period of time and impact of these reforms on Indian economy

CO 3: A comprehensive overview of e-banking and related issues

CO 4: An understanding of insurance framework in India with specific reference to IRDA Act 1999

CO 5: A detailed learning of types of insurance contract, principles, and importance of insurance contracts

Course BCM 307: Goods and Service Tax

The course content will enable the students:

CO 1: Understand various concepts of GST

CO 2: Understand the importance of GST in the Indian economy & its contribution to the economic development

CO 3: Understand the implications of GST

CO 4: Make them understand the practical aspect of value of goods/services and GST calculation

CO 5: Preparing tax payment, tax planning and tax returns

BCOM 4th Semester

Course BCM 401: Security Analysis and Portfolio Management

The course content will enable the students:

CO 1: To know about different investment avenues available in Indian market

CO 2: To learn the significance of economic, industry, technical analysis before doing any investment

CO 3: To gain knowledge of portfolio management with specific reference to models and theories of portfolio management

Course BCM 402: Advanced Accounting

The students will be in a position to

CO 1: Learn about methods of valuation of shares and goodwill

CO 2: Differentiate between hire-purchase and instalment system on the basis of their accounting treatment

CO3: Differentiate between Amalgamation, Absorption and External and Internal Reconstructions and their accounting treatment

CO 4: Know about the procedure of liquidation of companies

Course BCM 403: Auditing and Secretarial Practice

The course content will make the students familiar with:

CO 1: Auditing related concepts including internal check, internal control, audit program, audit evidence and verification and vouching

CO 2: Company auditors with specific reference to rules regarding their appointment and removal, their position and duties and liabilities

CO 3: Role of company secretary in present day businesses and provisions regarding their appointment and removal, their position and duties and liabilities

CO 4: Provisions regarding company meetings like annual general meeting, extraordinary meeting

CO 5: The course content will also help the students in learning how to write Audit Report, frame Agendas and Notices of meetings and make Minutes of meetings

Course BCM 404: Cost Management

The course content will enable the students:

CO 1: To understand the meaning of Cost Management

CO 2: To calculate the cost of Job, Batch and the Contracts

CO 3: To calculate the costs of different processes in case of process industries

CO 4: To understand the concept of marginal costing and its applications in business

CO 5: To know how marginal costing is different from total costing

CO 6: To be familiar with standard costing and to know how to find variances in material, labour and overhead costs

CO 7: To understand budgetary control and also to make different types of budgets, as, material budget, labour cost budget, sales budget, purchase budget etc.

Course BCM 405: Marketing Management

The course content will enable the students:

CO 1: To understand the meaning and approaches of marketing management

CO 2: To comprehend how do marketing strategies affect consumer behaviour

CO 3: To learn about the seven Ps of marketing mix and understand how these elements interact to consumer behaviour

CO 4: To gain knowledge of buzz technology adopted in marketing management.

CO 5: To have comprehensive knowledge of modern marketing practices

CO 6: To get complete understanding of the promotional strategies opted by companies.

CO 7: To understand new product development and how organisations take pricing decisions

CO 8: To become familiar with issues in marketing in a developing economy and gain understanding of rural marketing

B.COM 5th Semester

Course BCM 501: Income Tax Law

After studying the income tax law students will be able

CO 1: To understand the different heads of income

CO 2: To compute tax on the income

CO 3: To file income tax return and

CO 4: Understand the income tax administrative machinery in India

CO 5: Choose the career as income tax professional in large public accounting firms, industry, government, and income tax practitioner firms

CO 6: This subject will also helpful to the students who are perusing CA, LLB or other professional courses

Course BCM 502: Management Accounting

The course content will successfully help the students in:

CO 1: Understanding the areas where managerial decision making is facilitated by accounting

CO 2: Learning about the tools of financial analysis

CO 3: Calculating various liquidity, solvency and profitability ratios

CO 4: Making fund flow statement and cash flow statement

CO 5: Gaining knowledge of contemporary issues viz, responsibility accounting, price level accounting, social accounting and human resource accounting

Course BCM 504: Production and Operation Management

The course content will enable the students:

CO 1: To understand the meaning and features of production and operations management.

CO 2: To learn about various concepts like work measurement and work study

CO 3: To learn about project analysis and control.

CO 4: To gain knowledge about managing material.

CO 5: To have comprehensive knowledge of areas like inventory control, logistic management and supply chain management

Course BCM 505: Entrepreneurship and Small Business

The course will enable the students:

CO 1: To understand the meaning, characteristics and types of entrepreneurship

CO 2: To learn about the entrepreneurial development programmes

CO 3: To understand about the socio-economic environment prevailing in the business

CO 4: To have knowledge about the small-scale industries and MSMEs

CO 5: To get the complete understanding of how to start the business and various schemes provided by the government

Course BCM 506: Financial Markets and Services

The course content will enable the students:

CO 1: Understand the role and function of the financial system in reference to the macro economy

CO 2: Demonstrate an awareness of the current structure and regulation of the Indian financial services sector

CO 3: Describe the general structure of various financial markets

CO 4: To enrich their understanding on the fundamental concepts and working of financial service institutions

B.COM 6th Semester

Course BCM 601: Direct Tax Laws

The students will learn about:

CO 1: Clubbing of income of various sources and computation of total income after carry forwards and set off and all deductions

CO 2: Collection and payment of taxes

CO 3: Income tax authorities and appeal procedures

Course BCM 602: Financial Management

The students will learn about:

CO 1: Concept, scope and objectives of financial management

CO 2: Compounding and discounting techniques to calculate time value of money

CO 3: Capital budgeting techniques and cost of capital concept and calculations

CO 4: Theories of capital structure and dividend policy

CO 5: Management of working capital

Course BCM 603: Issues in Financial Reporting

The students will learn about:

CO 1: Conceptual framework of financial reporting and role of IASB in global conversion

CO 2: Major issues and trends in financial reporting

CO 3: Indian Accounting Standard with reference to Segment Reporting, Interim Reporting, Leases and Intangible Assets

Course BCM 604: Social and Business Ethics

The course content will enable the students:

CO 1: To understand the meaning and features of business ethics.

CO 2: To learn about the corporate social responsibility of companies.

CO 3: To know about the concept of corporate governance.

CO 4: To gain knowledge of latest business scams.

CO 5: To have comprehensive knowledge of areas listing clause, Sarbanes Oxley act etc

Course BCM 605: Operational Research

The course content will enable the students:

CO 1: To understand the meaning and scope of Operations Research.

CO 2: To learn about the decision-making strategies opted by companies.

CO 3: To know about basic programmes used by companies while undergoing any project (PERT and CPM)

CO 4: To gain knowledge of latest concepts of queuing theory and Markov analysis.

CO 5: To have comprehensive knowledge of areas like game theory, sequencing etc

MASTER OF COMMERCE

Program Outcomes

PO 1: M.Com course besides providing basic knowledge of wide variety of subjects is basic qualification for many competitive exams

PO 2: Students can join research, join teaching profession, do professional courses like CA/ICWA after doing M.Com degree

PO 3: A student holding a MCom Degree is well prepared to pursue careers as a corporate employee, project manager, risk manager, insurance agent, bank manager, tax advisor or as an entrepreneur

PO 4: The student will have adequate knowledge of wide variety of subjects including bank management, insurance management, project planning and control, business ethics, corporate governance, operations research, human resource management, management information system, training and development, tax planning etc.

Program Specific Outcomes:

PSO 1: Students will learn about statistical techniques and can pursue professions like financial analyst or quality control expert

PSO 2: Students will be well versed with Indian Accounting and Reporting Standards and will learn how to write and read financial statements of companies

PSO 3: Students will gain good knowledge of many human resource management and can explore their career as HR manager

PSO 4: The student will have adequate knowledge of marketing, production and materials management and can become corporate employees in these areas

PSO 5: Students have good scope in banking and insurance sector

PSO 6: Students will gain an insight into research methodology and will learn how to write and present the findings of their researches

Course MC 102: Quantitative Techniques for Business

The course content will help the students in learning:

CO 1: Probability theory: a numerical measure of uncertainty

CO 2: Different theoretical frequency distributions, as, Binomial, Poisson and Normal distributions

CO 3: Statistical estimation and Hypothesis Testing for large samples and small samples

CO 4: Analysis of Variance (ANOVA) to test whether the means of three or more populations is significantly different or not on the basis of sample information

CO 5: Estimation theory to estimate the population parameter from the corresponding sample information

CO 6: Statistical Quality Control which uses statistical techniques in controlling the quality of manufactured goods

Course MC 103: Modern Accounting Theory and Reporting Practices

The students will learn about:

CO 1: Conceptual framework of financial reporting and role of IASB in global conversion

CO 2: Major issues and trends in financial reporting

CO 3: Indian Accounting Standard with reference to Segment Reporting, Interim Reporting, Leases and Intangible Assets

CO 4: Preparation of financial statements as per International Standards

Course MC 104: Organisation Theory and Behaviour

After studying the subject, students will be able to get:

CO 1: A theoretical understanding of the structure and behaviour of organization as it develops overtime.

CO 2: Knowledge of oorganizational theories and behaviour, group decision making and communication

CO 3: An overview of motivation and leadership theories to equip the students to manage the behavioural aspects of business and improving the overall organizational effectiveness

CO 4: Knowledge of the concept of conflict as well as stress management

CO 5: Practical learning through case studies of real business world

Course MC 105: Marketing Management

The course content will enable the students:

CO 1: To understand the meaning and approaches, process of marketing management

CO 2: To analyse marketing environment

CO 3: To learn about the seven Ps of marketing mix and understand how these elements interact to consumer behaviour

CO 4: To gain detailed knowledge of product management.

CO 5: To have comprehensive knowledge of pricing strategies

CO 6: To get complete understanding of the promotional strategies opted by companies.

Course MC 106: Management Information System

By studying MIS, students can get:

CO 1: Basic knowledge of the different elements of information systems.

CO 2: A comprehensive overview of Management Information Systems.

CO 3: Understanding technical, strategic and tactical issues related to MIS

CO 4: Better understanding of the major information systems like TPS, MIS, DSS, ESS, and Expert Systems

CO 5: An overview of designing an information systems, features and important modules of Enterprise Resource Planning

MCOM 2nd Semester

Course MC 202: Research Methodology in Commerce

The course content will help the students

CO 1: To understand the meaning of Research, qualities of a researcher and inductive and deductive methods of conducting research

CO 2: To understand how to solve the problems through research and the financial aspects of research

CO 3: To know different techniques of data collection, analysis and presentation of data

CO 4: To have an understanding of the use of library in collection of information, and also to know sampling method, observation method, case study method, interview method, and questionnaire method of collecting information

CO 5: To have an understanding of how to write and present the findings of their researches

Course MC 203: Financial Management and Policy

The students will learn about:

CO 1: Concept, scope and objectives of financial management

CO 2: Compounding and discounting techniques to calculate time value of money

CO 3: Capital budgeting techniques and cost of capital concept and calculations

CO 4: Theories of capital structure and dividend policy

CO 5: Management of working capital

Course MC 204: Production and Materials Management

The students will be in a position to:

CO 1: Have an awareness and an appreciation of the importance of the operations and supply management to the sustainability of an enterprise.

CO 2: Understand the importance of facility locations and layouts.

CO 3: Get the knowledge of the importance of quality control.

CO 4: Apply techniques to measure quality control.

CO 5: Explain the importance of forecasting

CO 6: Demonstrate the ability to apply some mathematical forecasting techniques.

CO 7: Understand the concepts of work study, method study flow charts along with their significance in an enhancing productivity of organisation

Course MC 205: Operations Research

The course content will enable the students:

CO 1: To understand the meaning and scope of Operations Research.

CO 2: To learn about the decision-making strategies opted by companies.

CO 3: To know about basic programmes used by companies while undergoing any project (PERT and CPM)

CO 4: To gain knowledge of latest concepts of queuing theory and Markov analysis.

CO 5: To have comprehensive knowledge of areas like game theory, sequencing, queuing theory etc

Course MC 206: Business Policy and Strategic Management

The course content will enable the students:

CO 1: To understand the meaning and scope of strategic management and its significance in the areas of marketing, manufacturing, and human resource development

CO 2: To learn about the Ethical and Social Considerations in Strategy Development

CO 3: To know about strategy implementation and behavioural issues in its implementation

CO 4: To gain knowledge of business models for strategy formulation in internet economy

MCOM 3rd Semester

Course MC 301: Business Performance Measurement

The students will be in a position to:

CO 1: Understand the need and significance of business performance measurement

CO 2: Gain knowledge as to how activity-based costing, target costing and kaizen costing are to be used as performance measurement tools

CO 3: Compare traditional performance measures like return on investment with modern measures like economic value added

CO 4: Learn about balanced scorecard and its value creation potential

CO 5: Understand the concept of and issues relating to transfer pricing

Course MC 302: Tax Planning and Management

The course will

CO 1: Acquaint the students with theoretical and practical knowledge of tax planning and management techniques.

CO 2: Familiarize the student with major and latest provisions of the Indian tax laws and related judicial pronouncements pertaining to corporate enterprises having implications for various aspects of corporate planning with a view to derive maximum possible tax benefits admissible under the law.

CO 3: Enable the students to work in corporate sector relating to procedure and management of corporate sector in the field of taxation along with tax implications

CO 4: Give an overview of Goods and Service Tax

Course MC 305: Human Resource Development

The course will enable the students:

CO 1: To understand the meaning of human resource development

CO 2: To learn about the attitude of top management in the organization

CO 3: To give the knowledge to the students about the organization's culture and climate

CO 4: To make them understand the international comparison of Human Resource Development in India, Japan, China and Germany

Course MC 306: Industrial Relations

On successful completion of the course students will be able to:

CO 1: Demonstrate descriptive knowledge of the field of industrial relations.

CO 2: Understand the key participants, institutions, relationships and processes in employment relations

CO 3: Apply the essential concepts of industrial relations and their interrelationship at the personal, organisational and national levels

CO 4: Critically analyse theories, models, and paradigms in the field

CO 5: Recognise and consider the social, historical and equity issues within industrial relations

CO 6: Investigate solutions to industrial relations problems based on research and assessment of current practices

Course MC 313: Bank Management

The subject will provide knowledge about:

CO 1: Banking structure in India

CO 2: Management of Non-performing assets and role of Loan Recovery Tribunal

CO 3: Basics of investment management

CO 4: Difference between traditional and e-banking

Course MC 314: Insurance Management

The course will:

CO 1: Provide knowledge about principles and practices of general insurance: meaning, functions and scope of fire, engineering, accident, marine and aviation insurance

CO 2: Provide detailed understanding of industrial risk insurance which will help students in choosing the career as Risk Manager, Development officer, claim manager, investment advisor in these companies, or can become independent insurance advisor.

CO 3: Give the knowledge to the students about the life insurance

CO 4: Throw light on the legal framework of insurance in India

MCOM 4th Semester

Course MC 401: Project Planning and Control

The course will:

CO 1: Provide knowledge about project identification and project planning

CO 2: Provide detailed understanding of project appraisal through technical, financial, market, economic analysis

CO 3: Give the knowledge to the students about project implementation techniques which will help them to handle project successfully in their career as project mangers

Course MC 402: Knowledge Management

On successful completion of the course students will be able to:

CO 1: Develop an understanding of different types of knowledge assets in an organization

CO 2: Critically analyse the concepts and theories relevant to the acquisition, development and dissemination of knowledge in organisations at the individual, group and organisational level

CO 3: Demonstrate a comprehensive framework for designing and implementing successful knowledge management strategies for leveraging the intellectual assets of the organisation

Course MC 403: Business Ethics and Corporate Governance

The students will learn about:

CO 1: Concept of business ethics, values, virtues

CO 2: Ethical issues in the field of marketing, purchase, HR, finance and ethical dilemma faced by managers

CO 3: Framework of corporate governance in India with specific reference to governance mechanism

CO 4: Compare the corporate governance models in different countries

CO 5: Actual case studies in the field of business ethics

Course MC 407: Organisational Change and Development

The students will be able to:

CO 1: Get an in-depth understanding of organisational change and organisational development with the help of study of behavioural interventions such as Human Process Interventions (T-group, process consultation, third party interventions, team building; organizational confrontation meeting, coaching and mentoring, role focused interventions) and Techno structural Interventions (Restructuring organization, reengineering, employee involvement, work design and Strategic Interventions – Organisation and environment relationships, organization transformation)

CO 2: To apply these interventions for building individual, team, system, and process related competencies and helping organisations to achieve peak performance and become self-sustaining

CO 3: To have knowledge of the importance of adapting change in organisations and preparing them to deal with these changes when working as an employee in any organisation

Course MC 408: Training and Development

After completion of the subject:

CO 1: The students will understand the concepts and rationale of training and development through the importance of effective training and development policies

CO 2: They will gain knowledge of the traits of an effective trainer

CO 3: The students will understand the process of assessing the training needs

CO 4: The students will determine the various methodologies associated with training as well as development

CO 5: The students will become aware of the importance of evaluation of training and development programs

Course MC 409: Compensation Management

The course aims:

CO 1: To promote understanding in issues related to compensation in corporate sector

CO 2: To impart skills in designing, analysing and restructuring compensation management system, policies and strategies

CO 3: To facilitate understanding in the internal and external equities in compensation system

CO 4: To make students understand the compensation paid to special groups like Corporate Directors, Chief executives and Senior Managers.

POST GRADUATE DEPARTMENT OF COMPUTER SCIENCE

Bachelor of Computer Applications

Program Objectives:

After successfully completing B.C.A students will be able to:

PO1: BCA course strives to create outstanding computer professionals with ethical and human values to reshape the nation's destiny. This program aims to prepare young minds for the challenging opportunities in the IT industry, nourished and supported by experts in the fields.

PO2: The program enhances analytical, managerial and communication skill besides inculcating the virtues of self-study. The curriculum has been designed to cater to the ever-changing demands of information technology along with necessary inputs from the industry.

PO3: To develop the foundation for higher studies in the field of Computer Application.

PO4: To impart comprehensive knowledge with equal emphasis on theory and practice, designing and delivering an effective presentation in internet of things (IOT)

PO5: Develop entrepreneurship skills for customized software solutions for small and medium enterprises.

PO6: Develop programming skills to present ideas effectively and efficiently in android technology.

PO7: Apply networking technologies in integrated IT systems in an IT environment.

Program Outcome:

PSO1: Improve their computer literacy, their basic understanding of operative systems and a working knowledge of software commonly used in academic and professional environments.

PSO2: Develop criteria to organize and present different type of works in academic and professional environments.

PSO3: Use the Systems Analysis Design paradigm to critically analyze a problem.

PSO4: Function effectively and efficiently on teams to accomplish a common goal and demonstrate professional behavior.

PSO5: Develop IT-oriented security issues and protocols design and implement a web page.

PSO6: Improve communication and business management skills, especially in providing technical support.

SEMESTER-I

BCA-16-102; Fundamentals of Mathematical Statistics

CO1**.** Students will be able to solve various Financial, Scientific and Engineering fields' problems.

BCA-16-103; Computer Fundamentals and Computing Software

CO1. Familiarization with the terms like Operating System, peripheral devices, networking, multimedia, internet etc.

CO2. Ability to use internet for searching information on web, sending e-mails and many other tasks.

CO3. Skill to work with MS-Office

BCA-16-104; Problem Solving Through C

CO1. In-depth understanding of various concepts of C language

CO2. Ability to read, understand and trace the execution of programs

CO3. **Skill** to debug a program

CO4. Skill to write program code in C to solve real world problems

CO5. Understanding a functional hierarchical code organization

CO6. Ability to work with arrays of complex objects

CO7. Understanding a programming concept

CO8. Ability to handle possible errors during program execution.

BCA-16-105; Lab based on BCA-16-103

CO1. Familiarization with the terms like Operating System, peripheral devices, networking, multimedia, internet etc.

CO2. Ability to use internet for searching information on web, sending e-mails and many other tasks

CO3. Skill to work with MS-Word, Excel and PowerPoint

BCA-16-106; Lab based on BCA-16-104

CO1: Illustrate flowchart and algorithm to the given problem.

CO2: Illustrate Basic Structure of the C-PROGRAMMING, declaration and usage ofvariables.

CO3: Solve problems using operators

CO4: Simplify Conditional Operator, Precedence and Associativity in programs.

CO5: Exercise conditional and iterative statements to Write C programs

CO6: Solve problems using arrays and functions.

CO7: Solve problems on user defined data types.

CO8: Evaluate Type Casting, Declarations and expressions in C programs

CO9: Solve C programs using C preprocessor

CO10: Exercise standard functions of string in 'C'

CO11: Solve file handling programs in 'C'

CO12: Solve C programs using Pointers to access arrays, strings and functions.

CO13: Exercise on pointers, Structures and Unions.

SEMESTER-II

BCA-16-201; English (Compulsory)

BCA-16-202; Computer Organization

CO1. Representation of information, conversion of number systems and Boolean algebra

CO2. Basic building blocks, Combinational Logic design, Microinstructions and Instruction Cycle

CO3. Microprocessor Instruction set and addressing modes

BCA-16-203; Fundamentals of Web Programming

CO1.The student learn the following related to Web Programming

CO2.Basic Terminology like web server, browser, website, Internet, Intranet, Extranet, WWW.

CO3. HTML, DHTML, creating dynamic web pages, CSS, JavaScript, DOM, event handling using PHP

BCA-16-204; Object Oriented Programming using C++

CO1. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objectives

CO2.Understand dynamic memory management techniques using pointers, constructors etc.

BCA-16-205; Lab based on BCA-16-203

CO1: Identify the structure of HTML, JavaScript Function and Arrays, validation, PHPfunctions and strings.

CO2: Explain the history of the internet that are vital in understanding webdevelopment.

CO3: Explain concepts that are vital in understanding web development.

CO4: Demonstrate the ability to retrieve data from a database and present it in a webpage.

CO5: Demonstrate the web pages more dynamic and interactive.

CO6: Classify the functions of specific types of web pages.

CO7: Select the HTML5 technology to develop dynamic web pages

CO8: Create webpages using HTML5, CSS, PHP and JavaScript.

BCA-16-206; Lab based on BCA-16-204

CO1: Define the concept of Class and object.

CO2: Recite examples for class creation.

CO3: Perform programs on overloading, polymorphism, etc.

CO4: Simplify programming using OOP concepts.

CO5: Evaluate OOP programing features.

CO6: Design programs for various applications.

CO7: Use OOP concepts to solve problems.

CO8: Create small scale applications using object-oriented programming (OOPs).

CO9. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objectives.

CO10: Understand dynamic memory management techniques using pointers, constructors etc.

SEMESTER-III

BCA-16-301/BCA-16-302 Punjabi-A/ History & Culture of Punjab – A

BCA-16-303 Information System Design and Implementation

CO1. To impart the knowledge and importance of Information System and its aspects.

CO2. Students will be able to be analyze and design information systems.

CO3. Will be able to do System Planning and the Initial Investigation.

BCA-16-304; Computer Oriented Numerical Methods

CO1. Able to solve various Scientific and Engineering fields' problems through programs.

CO2. Skill to execute programs of various Numerical Methods.

BCA-16-305; Data Structures

CO1: Define the concept of data structures through ADT including List, Stack,Queues.

CO2: Remember algorithms and its analysis procedure.

CO3: Use appropriate data structures as applied to specified problem definition.

CO4: Analyze the complexity of given Algorithms.

CO5: Select appropriate data structures as applied to specified problem definition.

CO6: Design advance data structure using Non-Linear data structure.

CO7: Apply data structures for various data as per requirement.

CO8: Implement operations like searching, insertion, and deletion, traversing onvarious data structures.

BCA-16-306; Lab based on BCA-16-304

CO1.To demonstrate working of various numerical methods using C Programming.

CO2. To impart knowledge of various statistical techniques using C Programming.

CO3. To develop students' understanding through laboratory activities to solve problems related to above stated concepts.

BCA-16-307; Lab based on BCA-16-305

CO1: Define the concept of data structures through including List, Stack,Queues.

CO2: Remember algorithms and its analysis procedure.

CO3: Use appropriate data structures as applied to specified problem definition.

CO4: Analyze the complexity of given Algorithms.

CO5: Select appropriate data structures as applied to specified problem definition.

CO6: Design advance data structure using Non-Linear data structure.

CO7: Apply data structures for various data as per requirement.

CO8: Implement operations like searching, insertion, and deletion, traversing onvarious data structures.

SEMESTER-IV

BCA-16-401/ BCA-16-402; Punjabi-B/History & Culture of Punjab

BCA-16-403; Software Project Management

CO1. To understand the important concepts of project management.

CO2. To implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.

CO3. To apply skills and various processes to reach a project's objectives.

BCA-16-404; Operating System Concepts and Linux

CO1. Will be able to understand Operating System concepts and enable them to do programming using various Linux concepts and commands

BCA-16-405; Database Management System

CO1. Comprehensive knowledge of database models.

CO2. Ability to code database transactions using SQL.

CO3. Skill to write PL/SQL program

BCA-16-406; Lab based on BCA-16-404

CO1: Work confidently in Unix/Linux environment

CO2: Write shell scripts to automate various tasks

CO3: Master the basics of Linux administration

CO4: Scripts and programs will be accompanied by printed output demonstrating completion of a test plan.

CO5: Testing will demonstrate both black and glass box testing strategies

BCA-16-407; Lab based on BCA-16-405

CO1: Use DDL, DML commands.

CO2: Solve SQL queries to Insert, Delete, Update data in database

CO3. Implement the operations for making and using database

CO4: Define Queries, Database concept, Cursors, Triggers.

CO5: Discuss Error and Exception Handling techniques.

CO6: Use Views, Stored Procedures, Cursors, Triggers.

CO7: Classify Views, Cursors, Triggers, Stored Procedures.

CO8 Compare between database status before and after applying Triggers, CursorsDatabase constraints.

CO9: Solve Database Queries.

CO10: Categorize different types of Views.

SEMESTER-V

BCA-16-501; Computer Networks

CO1. Be able to understand the basic computer network technology.

BCA-16-502; Discrete Mathematical Structure

CO1. Develops formal reasoning.

CO2. Creates habit of raising questions.

CO3. Knowledge regarding the use of Discrete Mathematics in Computer Science.

CO4. Helpful in formulating questions.

CO5. Ability to communicate knowledge, capabilities and skills related to the computer engineer profession

BCA-16-503; Java Programming

CO1. Able to understand OOPS Concepts and use of Java Tokens, Statements, Constants, Variables, Data types, Operators, Expressions, Decision making and Branching, Classes, Objects, Methods, Arrays, Strings, Multiple Inheritance.

CO2. Able to Create Applets using AWT Controls.

CO3. Able to access the Database using JDBC.

BCA-16-504; Web Application Development using PHP

CO1.Write simple PHP code to perform some functionality for a web application.

CO2.Write simple code to fit PHP into the web environment. .

CO3.Implement User Defined Functions and Various Built In Functions In PHP

BCA-16-505; Lab based on BCA-16-503

CO1. Understand and implement syntax and semantics of Java

CO2. Design and develop applications and Applets

CO3. Design and develop database-oriented applications

CO4. Design and develop GUI-based applications

BCA-16-506; Lab based on BCA-16-504

CO1. Write simple PHP code to perform some functionality for a web application.

CO2. Write simple code to fit PHP into the web environment.

CO3. Implement User Defined Functions And Various Built In Functions In PHP.

SEMESTER-VI

BCA-16-601; E-Commerce

CO1. Be able to learn the basic concepts of e-business, e-commerce. Help to understand the basic concept of Business Intelligence, cloud computing, parallel computing.

BCA-16-602: Application Development using VB.Net

CO1. Design, create, build, and debug Visual Basic applications. .

CO2. Write Visual Basic programs using objects, Common Controls, MDI forms

CO3. How to create and use database with ASP.Net

CO4. How to use ADO.NET data sources using Data Grid view control.

BCA-16-603; Computer Graphics and Multimedia Applications

CO1. Will be able to Develop Computer Graphics programs and applications Using 'C'

CO2. Detailed knowledge of Computer Graphics and Multimedia Applications in the Real World, Training and Education, Image Processing, in home and office.

BCA-16-604; Lab based on BCA-16-603

CO1. Main objective of lab to measure the students 'understanding of the Computer Graphics techniques concepts and algorithm.

CO2. To implement of line drawing, circle drawing, polygon drawing, transformation of objects, scaling, viewing, and curve designing and modeling algorithm practically for graphics.

CO3. To motivate students, need to think critically and creatively in order to come with an alternate solution for an existing problem with computer graphics.

CO4. Will be able to Develop Computer Graphics programs and applications Using 'C', Auto CAD, Photoshop and Macro Media Director.

BCA-16-605; Major Project and Seminar

CO1. Will be able to create and present project using VB.NET.

CO2. To be able to apply some of the techniques/principles you have been taught

CO3. To carry out time planning for the project.

CO4. To follow correct grounding and shielding practices

CO5. To do effective trouble-shooting of the mini project.

CO6. To develop effective communication skill by delivering a seminar based on mini project

CO7. Demonstrate a through and systematic understanding of project contents.

CO8. Understand methodologies and professional way of documentation and communication.

CO9. Know the key stages in development of the project.

CO10. Extend or use the idea in mini project for major project.

Post Graduate Diploma in Computer Application

Program Objectives:

PO1: The broad objective of the PGDCA program is to prepare Post Graduates for productive careers in software industry, corporate sector, govt. organizations and academia by providing skill based environment for teaching and research in the core and emerging areas of the discipline.

PO2: The Program's thrust is on giving the students a thorough and sound background in theoretical and application-oriented courses relevant to the latest computer software development. The program emphasizes the application of software technology to solve mathematical, computing, communications/networking and commercial problems.

PO3: The aim is to develop dynamic computer professionals in short time. This covers all aspects and basics in Computer Application. It also has projects for developing full software in various software languages along with real time environment. The program prepares the student to

undertake Master's Program and for designing small business application software as per the need of the industry and the real world.

Program Outcomes

PSO1: The understanding to apply knowledge of computing and technological advances appropriate to the program.

PSO2: Skills to analyze a problem, and identify and define the logical modelling of solutions.

PSO3: An ability to design, implement and evaluate a computer-based system, process, component, or program to meet stakeholder needs.

PSO4: The knack to function effectively in teams to accomplish a common goal.

PSO5: A sense of professional, ethical, legal, security and social issues and responsibilities.

PSO6: Effectiveness in communicating with a wide range of audiences.

PSO7: An ability to analyze the local and global impact of business solutions on individuals, organizations, and society.

SEMESTER-I

PGD-1101: Computer Fundamentals

CO1. Familiarization with the terms like Operating System, peripheral devices, networking, multimedia, internet etc.

CO2. Ability to use internet for searching information on web, sending e-mails and many other tasks.

PGD-1102; Computer Programming using C

CO1. Practical understanding of various concepts of C language

PGD-1103; Database Management System

CO1. Familiarization with Database Management System and ability to code database transactions using SQL or PL/SQL.

PGD-1104; Data Communications and Networks

CO1. Be able to understand the basic computer network technology.

PGD-PR1105/Lab1; (Based on PGD-1101 & PGD-1102

CO1. Overview of Desktop computer and other components of computers

CO2. Text formatting, creation of document, Mail Merge, tables in MS-word covered.

CO3. Working on spreadsheet and mathematical function, Charts.

PGD-PR1106 Lab2; (Based on PGD-1103)

CO1: Use DDL, DML commands.

CO2: Solve SQL queries to Insert, Delete, Update data in database

CO3. Implement the operations for making and using database

CO4: Define Queries, Database concept, Cursors, Triggers.

CO5: Discuss Error and Exception Handling techniques.

CO6: Use Views, Stored Procedures, Cursors, Triggers.

CO7: Classify Views, Cursors, Triggers, Stored Procedures.

CO8 Compare between database status before and after applying Triggers, CursorsDatabase constraints.

CO9 Solve Database Queries.

CO10 Categorize different types of Views.

SEMESTER-II

PGD-2101; Object Oriented Concepts Using JAVA

CO1. Able to understand OOPS Concepts.

CO2. Able to Create Applets using AWT Controls.

CO3. Able to access the Database using JDBC

PGD-2102 Web Technologies

CO1. Basic Terminology like web server, browser, website, Internet, Intranet, Extranet, WWW, URL

CO2. HTML, DHTML, CSS, Java script.

PGD-2103; Software Engineering

CO1. To understand the concepts of project management

CO2. To implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.

PGD-2104; Computer Based Accounting

CO1. To implement a systematic approach to design, development, operation, and maintenance of a *software* system.

CO2. To apply the methods and procedures for software development that can scale up for large systems

PGD-PR2105; Lab3 (Practical based on PGD2101)

CO1. Understand and implement syntax and semantics of Java

CO2. Design and develop applications and Applets

CO3. Design and develop database-oriented applications

CO4. Design and develop GUI-based applications

CO5. Able to understand OOPS Concepts.

CO6. Able to Create Applets using AWT Controls.

CO7. Able to access the Database using JDBC.

PGD-PR2106; Lab4 (Practical based on PGD2102)

CO1: Identify the structure of HTML, JavaScript Function and Arrays, validation, PHPfunctions and strings.

CO2: Explain the history of the internet that are vital in understanding webdevelopment.

CO3: Explain concepts that are vital in understanding web development.

CO4: Demonstrate the ability to retrieve data from a database and present it in a webpage.

CO5: Demonstrate the web pages more dynamic and interactive.

CO6: Classify the functions of specific types of web pages.

CO7: Select the HTML5 technology to develop dynamic web pages

CO8: Create webpages using HTML5, CSS, PHP and JavaScript.

PGD-2107: Project Work:

Project will involve Development of Business Application / Web Site

CO1. Will be able to create and present project using any web technology so that they design website

CO2. To be able to apply some of the techniques/principles you have been taught.

CO3. To carry out time planning for the project.

CO4. To follow correct grounding and shielding practices

CO5. To do effective trouble-shooting of the mini project.

CO6. To develop effective communication skill by delivering a seminar based on mini project

CO7. Demonstrate a through and systematic understanding of project contents.

CO8. Understand methodologies and professional way of documentation and communication.

CO9. Know the key stages in development of the project.

CO10. Extend or use the idea in mini project for major project.

Masters of Science (Information Technology)

Program Objectives:

PO1: The educational objectives of the program is to enable the students to have a holistic and all-round grooming to be a thorough professional in the field of IT.

PO2: Develop software solutions to problems across a broad range of application domains through analysis and design.

PO3: Contribute to research in their chosen field and function and communicate effectively, to perform both individually and in a multi-disciplinary team.

PO4: Continue the process of life-long learning through professional activities; adapt themselves with ease to new technologies, while exhibiting ethical and professional standards and will be able to work collaboratively as a member or leader in multidisciplinary teams.

PO5: Students will be able to apply knowledge of computing fundamentals, computing specialization and domain knowledge for the abstraction and conceptualization of computing models from defined problems and requirements.

PO6: They will have the ability to understand and analyze a given real-world problem and propose feasible computing solutions.

PO7: They will possess leadership and managerial skills with best professional ethical practices and social concern and will be able to communicate technical information effectively, both orally and in writing.

Program Outcomes:

PSO1: Programmer or Software Engineer

PSO2: Web Designer, Hardware Designer/Engineer

PSO3: System Administration

PSO4: Technical Support/Writer

PSO5: IT Officer

PSO6: Research Staff Member

PSO7: Systems Analyst

PSO8: Logic Designer

PSO9: Computer Scientist in R & D laboratories.

SEMESTER-I

MS-66: Linux Administration and Programming

CO1. Perform essential Linux commands such as installation, searches and manipulating files.

CO2. Operate running Linux systems by managing the boot process, scheduling jobs, updating the system, monitoring system performance and managing security.

MS-61; Software Engineering

CO1. To implement a systematic approach to design, development, operation, and maintenance of a *software* system.

MS-62; Computer Algorithms

CO1. Will be able to use, analyze and evaluate different problem solving techniques.

MS-42; Operating System Concepts

CO1. Will be able to understand Operating System concepts as mentioned below and enable them to do programming using various Linux concepts and commands.

MS-63; Minor Project Based on 66

CO1. Designing and creation of a project using Linux commands and file system.

MS-64; Minor Project Based on 62

CO1. Designing, Creation and Analysis of a project based on different algorithms.

SEMESTER-II

MS-45; Advance Java and Network Programming

CO1. Able to understand OOPS Concepts.

CO2. Able to Create Applets using AWT Controls.

CO3. Able to access the Database using JDBC.

MS-65; E- Commerce and Emerging Trends

CO1. Learn the basics and usage of e-commerce in IT and business.

MS-60; Advanced Database System and MySQL

CO1. Learn the basics of DBMS and its principles.

CO2. Learn about Transaction mechanism and concurrency control during transaction.

CO3. Learn and implement the operations for making and using database with help of SQL and PL/SQL.

MS-67; Artificial Intelligence

CO1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2. Understanding the concepts and scope of AI in future.

MS-27; SEMINAR

CO1. Students will be able to understand the latest issues and topics of information technology and computer science.

CO2. Their communication and presentation skills will be enhanced.

MS-56; Minor Project Based on MS-45& MS-60

CS1. Designing and Creation of Project using concepts of java as front end and MySQL as backend.

MS-68; Minor Project Based on MS-67

CO1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs and explore more sophisticated Prolog code on their own.

SEMESTER-III

MS-32; .NET Framework and C#

CO1. Introduction to .Net Framework and concepts of OOPs using C#.

CO2. Create and deploy windows form and ASP.Net applications

CO3. Create Applications using ADO.NET.

MS-69; Theory of Computation

CO1. Will know about Automata, Transition Systems, Language, Grammar and

CO2. Deterministic & Non-Deterministic Finite State Machines.

MS-39; Computer Graphics

CO1. Understanding of Computer Graphics and Its Applications

CO2. Will be able to implement the principles and commonly used paradigms and techniques of computer graphics.

CO3. Will be able to use OpenGL proficiently using C / C++.

MS-14; Systems Approach to Management and Optimization Techniques

CO1. Convert the problem into a mathematical model.

CO2. Understand variety of problems such as assignment, transportation, travelling salesman etc.

MS-18; SEMINAR 2

CO1. Students will be able to understand the latest issues and topics of information technology and computer science.

CO2. Their communication and presentation skills will be enhanced.

MS-33; Minor Project Based on MS-32

CO1. Designing and creation of a project in C#.Net.

MS-59; Minor Project Based on MS- 39

CO1. Able to implement the principles and commonly used paradigms and techniques of computer graphics using OpenGL proficiently in C / C++.

SEMESTER-IV

MS-21; Major Project Industrial training 4-Month

CO1. Students will acquire the ability to make links across different work area of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.

CO2. Students will understand the challenges of real time in industry.

CO3. Students will get platform to start their carrier.

Bachelor of Science (Computer Science)

Program Objectives:

PO1: The revised and restructured curriculum for the Three-year integrated course is systematically designed considering the current industry needs in terms of skills sets demanded under new technological environment.

PO2: Information and Communication Technology (ICT) has today become integral part of all industry domains as well as fields of academics and research.

PO3: It also endeavors to align the programmer structure and course curriculum with student aspirations and corporate expectations.

PO4: The proposed curriculum is more contextual, industry affable and suitable to cater the needs of society and nation in present day context.

Program Outcomes:

PSO1: Serve as the Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software.

PSO2: Serve as the Computer Engineers with enhanced knowledge of computers.

PSO3: Work as the Hardware Designers/Engineers with the knowledge of Networking Concepts.

PSO4: Work as the System Engineers and System integrators. Serve as the System Administrators with thorough knowledge of DBMS.

PSO5: Work as the Support Engineers and the Technical Writers.

PSO6: Serve as the IT Officers in Banks and cooperative societies.

PSO7: Serve as the Web Designers with latest web development technologies.

SEMESTER-I

Paper–CS01; Theory-A Computer Fundamentals

CO1. Familiarization with the terms like Operating System, peripheral devices, networking, multimedia, internet etc.

Paper –CS02; Theory-B PC Software

CO1. Concepts of Files and directories in MS-DOS, Directory Commands and General Commands, Batch Files

CO2. Windows operating system – Interface and organizing files and folders

Paper – PCS01; Practical-C Practical Based on Paper – CS02

CO1. Implementing Concepts of Files and directories in MS-DOS, Directory Commands and General Commands

CO2. Creating Batch Files in MS-DOS

CO3. Organizing files and folders in Windows operating System

CO4. Working with Word processing, spreadsheet and MS Power Point software.

SEMESTER-II

Paper–CS03; Theory- A Operating System Concepts

CO1. Concepts of operating systems.

CO2. CPU scheduling algorithms

CO3. Process communication and process cycle

CO4. Deadlock prevention, avoidance and recovery.

CO5. Methods of memory access and memory management techniques

Paper –CS04; Theory-B-C Programming

CO1. In-depth understanding of various concepts of C language

CO2. Ability to read, understand and trace the execution of programs

CO3. Ability to handle possible errors during program execution.

Paper – PCS02 Practical-C Practical Based on Paper – CS04

CO1. In-depth understanding of various concepts of C language

CO2. Ability to read, understand and trace the execution of programs

CO3. Skill to debug a program.

CO4. Skill to write program code in C to solve real world problems

CO5. Understanding a functional hierarchical code organization.

CO6. Ability to handle possible errors during program execution

SEMESTER-III

Paper – CS05; Theory-A Computer Organization

CO1. Representation of information, conversion of number systems and Boolean algebra

CO2. Basic building blocks, Combinational Logic design, Microinstructions and Instruction Cycle

Paper –CS06; Theory-B Object Oriented Programming using (C++)

CO1. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objectives.

CO2. Classify inheritance with the understanding of early and late binding, usage of exception handling

Paper – PCS03; Practical-C Practical Based on Paper – CS06

CO1. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objectives.

CO2. Classify inheritance with the understanding of early and late binding, usage of exception handling.

SEMESTER-IV

Paper – CS07; Theory-A Database Concepts

CO1. Concepts of database approach, Overview of Data models and data independence

CO2. Relational Model, Relational Algebra and Calculus

CO3. Database Architecture and Data Normalization

Paper –CS08; Theory-B Data Structures

CO1. Apply the programming techniques to implement various data structures and perform various operations on those data structures.

Paper – PCS04; Practical-C/Practical Based on Paper – CS08

CO1. Apply the programming techniques to implement various data structures and perform various operations on those data structures.

SEMESTER-V

Paper – CS09; Theory-A-Project Management

CO1. Basic Concepts like features, life cycle, tools and techniques, computerized PM, Roles and responsibilities of Project manager

CO2. Feasibility report, implementation and financial issues

CO3. Project direction, coordination, control and performance

CO4. Report writing

Paper –CS10; Theory-B: Relational Database Management System

CO1. SQL commands, data constraints, Operators and Functions

CO2. To be able to work with SQL objects

CO3. Concept of Database Security and Privileges

CO4. Fundamentals of PL/SQL, Concepts and Writing PL/SQL codes

Paper – PCS05 Practical-C Practical Based on Paper – CS10

CO1. Implement the concepts of SQL

CO2. Writing queries in SQL.

CO3. Writing PL/SQL codes for database handling

SEMESTER-VI

Paper – CS11; Theory-A/E-Commerce

CO1. Learn the basics of e-commerce in IT and business.

CO2. Learn about business to business and business to consumer relationship.

CO3. Learn about marketing strategies and marketing segments.

Paper –CS12; Theory-B Web Programming

CO1. The student learns the following related to Web Programming-

CO2. Basic Terminology like web server, browser, website, Internet, Intranet, Extranet, WWW, URL

CO3. HTML, DHTML, creating dynamic web pages, CSS, JavaScript, DOM, event handling using PHP

Paper – PCS06

Practical-C Practical Based on Paper – CS12

CO1. The student learns the following related to Web Programming-

CO2. Basic Terminology like web server, browser, website, Internet, Intranet, Extranet, WWW, URL

CO3. HTML, DHTML, creating dynamic web pages, CSS, JavaScript, DOM, event handling using PHP

B.A. Economics Programme

Programme Outcomes:

After successfully completing B.A. Economics Programme, students will be able to:

PO1 Technical Knowledge: Use various tools for economic analysis and apply knowledge of Micro Economics and Macro Economics approach for their personal benefit as well as for the benefit of national and global economy.

PO2 Problem Analysis: Recognize and study the problems of various sectors of Indian economy, Regional economy and Global economy using the economic ways of thinking, theories, concepts and laws.

PO3 Design/Development of Solutions: Design policies and solutions for the economic problems of India and the global economy at large.

PO4 Usage of Modern Tools: Create, select, and apply appropriate techniques, resources, and modern IT tools for economic analysis.

PO5 The Student and Society: Apply the knowledge of economic concepts, laws and theories, for the betterment of economic environment, for the society at large.

PO6 Environment and Sustainability: Develop an economic way of thinking which will lead to the economic growth of the country by protecting environment along with sustainable development.

PO7 Ethics: Inculcate ethical values in the business/private and the government sector. Define responsibilities and norms in the business environment as well as the government for the welfare of the society.

PO8 Individual and Team Work: Work efficiently as an individual, and as a part or leader of a team, having interdisciplinary approach.

PO9 Communication: Communicate effectively on the economic activities with the community and the society by acquiring knowledge of the national and the global economy.

PO10 Project Management and Finance: Apply knowledge of the economic principles for the efficient functioning of various sectors of the economy - whether private or government - and also devise sources for financing them.

PO11 Life-long Learning: Understand the nature of any discipline as a continuous process of development and welfare of the human being

Programme Specific Outcomes

PSO1: Explain the basic concepts, laws and theories related to the economic behaviour of the human being.

PSO2: Inculcate the economic way of thinking.

PSO3: Apply economic analysis in practice.

Course Outcomes

BA I (1st Semester)

Course: Micro Economics

After successfully completing this course, students will be able to

CO1: Describe basic economic problems and look towards the economy from the view point of a consumer, a producer, a factor of production and understand the role of various market forms.

CO2: Explain division of market from consumers angle and supply of the products from the producers' side.

CO3: Interpret concepts related to utility, demand and supply in market.

CO4: Analyse process of production in economy, laws and variables related to the production function.

CO5: Demonstrate various forms of market and price determination concept of firm.

CO6: Describe factors of production involved in process of production and theories related distribution.

CO7: Apply the tools used for economic analysis.

B.A. I (2nd Semester)

Course: Macro Economics

After successfully completing this course, students will be able to:

CO1: Illustrate a macroeconomic approach towards economy in contrast with the microeconomic approach.

CO2: Make a detailed enquiry into generation, calculation and measurement of national income.

CO3: Describe way of money facilitates exchanges and develop market and the economy.

CO4: Explain human behaviour creating effective demand which determines level of output and employment in economy.

CO5: Analyse approaches towards value of money and price level in economy.

CO6: Interpret causes and controlling measures of cyclical fluctuations in economy

CO7: Assess macro policies-monetary and fiscal and its applications in the functioning of the economy.

CO8: Evaluate developments in theory of employment of economics.

BA II (3rd Semester)

Course: Public Finance and International Economics

After completing this course, the students will be able to:

CO1: Explain nature, scope and importance of Public Finance.

CO2: Describe Causes for the Recent Growth of Public Expenditure in India.

CO3: Explain Classification and Canons of taxation.

CO4: Explain Incidence and Impact of Taxation.

CO5: Explain Public Debt and Deficit Financing.

CO6: Examine theories of International Trade.

CO7: Describe problem and prospect of regional Blocks.

CO8: Examine Balance of Payment and Causes and Measures to correct the disequilibrium.

CO9: Explain Exchange rate and its Determination.

BA II (4th Semester)

Course: Quantitative Methods

After completing this course, the students will be able to:

CO1: Explain Elementary Idea of Sets and Functions and their Applications of Micro and Macro Economics.

CO2: Understand Matrices and Measures of Central Tendency.

CO3: Describe Correlation and Simple Regression Analysis.

CO4: Explain Interpolation and Lagrange's Method.

CO5: Understand Concepts, Problems, Importance and test of Adequacy of Index Number.

CO6: Describe Time Series Analysis.

B.A. II Honours (3rd Semester)

Course: Economics of Agriculture

CO1: Describe Concept, Scope, Objectives, Importance and Problems of Agriculture and understand the interdependence between Agriculture and Industry.

CO2: Describe and understand various models for transforming Agriculture.

CO3: Explain various land reforms and the impact of these institutional reforms on productivity.

CO4: The role of agricultural taxation and agricultural price policy in generating farm incomes.

CO5: Analyse the New agricultural strategy and Green Revolution.

CO6: A fair understanding of the problems faced by small farmers and agricultural labourers.

CO7: Explain Agricultural credit, marketable and marketed surplus with special reference to India.

B.A. II Honours (4th Semester)

Course: Industrial Economics

After completing this programme the student will be able to:

CO1: Describe meaning, scope, need and significance of industrial economics; and understand its role in economic development.

CO2: Explain the organizational forms and various objectives of a firm.

CO3: Explain factors affecting industrial locations and theories of industrial location.

CO4: Describe the role of industrial concentration vis-a-vis dispersal of industries in India.

CO5: Explain market structure and profitability of different industries.

CO6: Explain the growth of firms by vertical integration, diversification, mergers, etc.

CO7: Understand the Industrial Policy of India since Independence and analyse the trends in industrial in growth since 1991 in India.

B.A. III (5th Semester)

Course: Economics of Development and Planning

After successfully completing this course, students will be able to:

CO1: Describe concepts of Development and Growth of economies.

CO2: Describe characteristics of developed and developing economies.

CO3: Analyse constraints on the process of development of various countries.

CO4: Evaluate theories and ways of development of economies.

CO5: Illustrate role of foreign capital in development of the economies.

CO6: Appraise approaches towards process of development take place in an economy.

CO7: Assess instruments of macroeconomic policies, monetary and fiscal along with their role in controlling cyclical fluctuations in an economy.

CO8: Explain overview of economic planning in India and inclusive approach towards growth of the Indian economy.

B.A. III (6th Semester)

Course: Indian Economy

After successfully completing this course, students will be able to:

CO1: Describe status of the Indian economy as a developing economy in comparison with world economy.

CO2: Describe status of agricultural and industrial sector of the Indian economy.

CO3: Explain poverty and unemployment as economic problems in the India.

CO4: Examine flagship programme of the Indian government and 12th plan of five year economic planning in India. Industrial policy and LPG model for India.

CO5: Interpret demographic features of the Indian economy and problems. Understand the taxation structure of India and the dynamics of Centre-State financial relations.

CO6**:** Analyse the role of Export-Promotion, Import-Substitution and MNCs in Indian context.

B.A. III Honours (5th Semester)

Course: Paper –I: Money and Banking

After completing this course, students will be able to:

CO1: Explain definition, components and determinants of supply of money.

CO2: Explore measures of supply of money in India.

CO3: Describe Classical, Keynesian liquidity preference, Friedman' restatement of quantity theory of money.

CO4: Examine functions of Central Banking, techniques of Monetary Management and Monetary Policy of Reserve Bank of India.

CO5: Describe functions of Commercial Bank and reforms of Indian Banking system since 1991.

CO6: Examine role and structure of NBFIs in India.

CO7: Interpret features and role of International Monetary Fund.

CO8: Illustrate features and role of World Bank and Asian Development Bank.

B.A. III Honours (6th Semester)

Course: Public Finance

After successfully completing this course, students will be able to:

CO1: Describe role of Government in an economy and way to maximum social advantage.

CO2: Describe sources of income, types and principles of expenditures of Government and general importance of Public finance.

CO3: Analyse effects of public expenditure on production, distribution, stability and innovation.

CO4: Analyse concepts and principles related to public revenue and taxation.

CO5: Examine types and forms of public debt along with ways to redeem and administer various forms of public debt.

CO6: Illustrate functional and economic classification of budget and its use as an economic instrument.

CO7: Understand fiscal federalism along with development and functional finance.

B.Com. Programme

Programme Outcomes:

After successfully completing B.Com. Programme students will be able to:

PO1: Students will able to learn depth knowledge of commerce.

PO2: Develop the skill of applying concepts and techniques used in Commerce for real life problems.

PO3: Students will develop reading, writing, speaking skills and Business correspondence.

PO4: Creates awareness among society about Law and Legislations related to commerce and business.

PO5: Students will use effectively recent Trends in Business, Organizations and Industries.

PO6: Students will communicate effectively about Economic Environment of Country as well as world.

PO7: Students will learn effectively use practical skills in real life related to banking and corporate world.

PO8: Students will be able to develop knowledge level and awareness about Recent Trends of commercial World.

PO9: Students will be aware and use technologies effectively to communicate ideas in the area of commerce.

PO10: Students will critically conduct research and evaluate research findings in area of commerce.

PO11: Students will learn group synergy and to work in group.

PO12: Students will Recognize and understand individual and organizations ethical issues and its application in society.

Programme Specific Outcomes

PSO1: Students will be able to apply basic skills learnt in commerce necessary for analysis of various problems in accounting, marketing, business economics, management and finance.

PSO2: Students will demonstrate progressive affective domain development of values, the role of accounting in society and business.

PSO3: Students will able to demonstrate quantitative and qualitative knowledge in key areas of organization behaviour.

PSO4: Students will able to evaluate national and international issue and discussion on economic, commercial and business -related topics.

Course Outcomes

B.Com. (Semester I & II)

Course: Business Economics

After completing this course, the students will be able to:

CO1: Understand the concept and applications of business economics

CO2: Explain the application of economic theory to the decision-making process of business enterprises

CO3: Explain the concept of demand, demand forecasting and utility

CO4: Demonstrate various forms of markets and their price determination

CO5: Explain the concept of consumer equilibrium with the help of utility and indifference curve.

CO6: Illustrate macroeconomic approach towards economy in contrast with the microeconomic approach

CO7: Get an in-depth knowledge of national income

CO8: Assess various macroeconomic policies

CO9: Understand determination of various factors of production.

CO10: Explain the views of classical and neo-classical economists of employment.

BCOM II (Semester III)

Course: Business Mathematics and Statistics

After successfully completing this course, students will be able to:

CO1: Understand and apply the knowledge of matrices and determinants in significant business and economic problems.

CO2: Gain knowledge about solving equations and system of equations.

CO3: Determine and study the changes that occur in a variable when other variables on which it depends changes.

CO4: Apply the knowledge of technique of maximisation and minimization in business problems like maximizing revenue and profits, minimizing costs etc.

CO5: Understand the basic statistical tools useful in day-to-day decision making which aids businesses.

CO6: Investigate and draw inferences from the available data and aid further conclusions.

CO7: Use the concept of time series to measure changes in values of data caused by regular and irregular changes over time.

CO8: Measure relative changes in phenomena like price, cost of living, national income at different points of time.

B.Com. (Semester IV)

Course: Quantitative Techniques and Methods

After successfully completing this course, students will be able to:

CO1: Use the powerful qualitative techniques like statistical techniques and operations research techniques for solving various decision-making problems of business and industry.

CO2: Use the theory of probability in the field of statistics, economics, commerce and social sciences to make predictions in the face of uncertainty.

CO3: Apply the technique of linear programming to determine optimal allocation of limited resources to meet the given objectives.

CO4: Use the statistical techniques of interpolation and extrapolation to find out relevant missing or unknown values in a given series.

CO5: Understand and measure the extent of closeness of the relationship between two or more variables using the concept of correlation.

CO6: Estimate the value of a dependent variable on the basis of the given value of the independent variable using regression analysis.

B.Com. II Honours (Semester III)

Course: Development Economics

After completing this course, the students will be able to:

CO1: Explain Economic development and its determinants.

CO2: Explain Traditional and Modern Criteria to measure Economic Development.

CO3: Describe Balanced and Unbalanced growth.

CO4: Explain Sustainable development, its importance and indices.

CO5: Describe various classical theories of Development.

CO6: Explain objectives, achievements and constraints of India's Five Years Plans.

CO7: Describe models used in Economic Planning.

CO8: Explain growth and distribution trends regarding Poverty, Unemployment, and Inequality in India.

B.Com. II Honours (Semester IV)

Course: Industrial Economics

After completing this course, the students will be able to:

CO1: Explain pattern and phases of industrialization and changes in industrial structure.

CO2: Describe factors influencing location of industries.

CO3: Describe industrial productivity and efficiency and measures to improve them.

CO4: Explain role of industrialization in economic development.

CO5: Explain importance and sources of industrial finance in India.

CO6: Describe impact of Economic Reforms on India's Industrial Growth.

CO7: Describe role and performance of Public Sector Enterprises in Economic development.

CO8: Explain Problems and Performance of Micro, Small, Medium Enterprises in India.

B.Com. III (Semester V)

Course: Indian Economy

After completing this course, the students will be able to:

CO1: Explain State and nature of Indian Economy.

CO2: Describe Appraisal of Economic Reforms Programme.

CO3: Estimate National income of India and inter regional variations.

CO4: Explain demographic features of Indian population.

CO5: Explain Growth, problems of Capital Market and Reforms since 1991.

CO6: Contemporary Problems of India's International Trade.

CO7: Describe Objectives, Achievements and Failure of Economic planning in India.

B.Com. III (Semester VI)

Course: Sectoral Aspects of Indian Economy

After completing this course, the students will be able to:

CO1: Explain Features and Productivity of Agriculture sector.

CO2: Explain agricultural finance and agricultural policy.

CO3: Describe Industrial Development during the Planning Period.

CO4: Explain importance, problem and Govt. Policy of Small Scale and Cottage industries in India.

CO5: Describe Growth and contribution of Service Sector in India in Pre and Post Reform Period.

CO6: Explain problems of Indian Economy (Poverty, Unemployment, Inflation, Unequal distribution of Income and wealth).

B.Com. III Honours (Semester V)

Course: Money and Banking

After completing this programme the student will be able to:

CO1: Describe money and measures of money supply of economy.

CO2: Describe determination of laws, theories of alternative money stock measures.

CO3: Explain concept of demand for money and price.

CO4: Explain theories of demand of money like Keynes and Friedman.

CO5: Describe concept of money supply.

CO6: Explain the concept on Inflation and its over-all impact on the progress of a nation.

CO7: Describe banking-it's functions, liabilities and assets.

CO8: Analyse present status of commercial banks, cooperative banks and development banks

CO9: Describe non-banking financial institutions (NBFI's) in India with nature, types, significance and its performance and unregulated credit markets.

CO10: Explain the functioning of RBI, it's nature and role.

CO11: Analyse the Monetary Policy of India.

CO12: Describe the banking sector reforms in India and their impact.

B.Com. Honours (Semester VI)

Course: International Economics

After completing this programme the student will be able to:

CO1: Describe the concept of Absolute Advantage Theory of Adam Smith and Comparative Cost Theory by Ricardo.

CO2: Explain the Heckscher-Ohlin theory of International trade.

CO3: Have an understanding of the concepts of terms of trade.

CO4: Illustrate the difference between free trade and controlled trade.

CO5: Explain effects of tariffs and non- tariffs on trade equilibrium.

CO6: Describe concept of balance of trade and balance of payment with equilibrium and disequilibrium.

CO7: Illustrate fiscal and monetary policies for internal external balance of payment.

CO8: Explain exchange rate systems. Fixed vs. Flexible exchange rates.

CO9: Describe the theories of Exchange Rate - BOP Theory and PPP Theory.

MA Economics Programme

Programme Outcomes:

Successful completion of this course will enable students to –

PO1: Understand and apply various micro and macro-economic tools in day to day working of corporates.

PO2: Analyse the linkage/interface among various micro and macro-economic parameters.

PO3: Understand mathematical and statistical tools necessary for research in Economics.

PO4: Understand internal and external environment in developing appropriate economic and market strategy.

PO5: Build sound basis for understanding, analyzing and evaluating Indian economic issues and suggest appropriate measures.

PO6: Identify and analyse development issues of world in general and India in particular.

PO7: Develop required skill for in depth analysis of economic events along with causes and effects of their occurrence.

PO8: Acquire sound knowledge of concepts and structure of money market and capital market

PO9: Build knowledge of concepts and current regime concerning International trade.

PO10: Develop competence in corporate efficiency and rational decision making.

PO11: Evaluate Indian Economic policies relating to agriculture, industry, trade, demography monetary and fiscal policy etc.,

PO12: Find and suggest appropriate solutions for Balance of payment problems and Foreign exchange problems.

PO13: Develop competence to become corporate economic analysist and macro-economic analysist.

Programme Specific Outcomes:

PSO1: Understand basic concepts, laws and theories related to economic behaviour.

PSO2: Apply economic analysis in various business and corporate situations.

PSO3: Develop in depth understanding of micro and macro-economic concepts and their application.

PSO4: Analyse the economic impact of various state policies and government decisions.

PSO5: Inculcate rational, logical and economic way of thinking.

PSO6: Become environmentally conscious and adopt economically sustainable ways of life.

Course Outcomes

MA Economics (Semester I and II)

Course: Micro Economics

Successful completion of this course will enable students to -

CO1: Develop understanding of Central Problems of Economics:

CO2: Understand Concept, Stability, Existence, Uniqueness and Types of Equilibrium.

CO3: Analyse Consumer Choice in various economic situations.

CO4: Understand and evaluate market demand and supply situation.

CO5: Gain knowledge concerning problems of adverse selection and moral hazards.

CO6: Build understanding of concepts and applications in the field of production.

CO7: Make decision on the choice of ideal plant size for production activities of various kinds.

CO8: Understand concepts related to production costs along with economies and diseconomies of scale.

CO9: Analyse various product and factor markets and their competitive environment.

CO10: Evaluate govt policies in the light of principles of welfare economics.

MA Economics (Semester I and II)

Course: Macroeconomics

After successfully completing this course, students will be able to:

CO1: Be familiarized with the Classical and Keynesian Models of Income and Employment Determination.

CO2: Get an insight into the Keynesian consumption function and various consumption theories- Absolute Income hypothesis, Relative Income hypothesis, Permanent Income hypothesis, Life Cycle Hypothesis and Random Walk Hypothesis.

CO3: Have a deep understanding about types of Investment, role of investment using Investment Multiplier and various theories of investment such as- Classical and Keynesian Theories of Investment, Accelerator Theory of Investment, Neo-Classical Theory of Investment and Tobin's-q Theory of Investment and effects of uncertainty on Investment.

C04: Comprehensively equip themselves with theoretical and empirical attempts to define money, explain the components of supply of money, analyse credit creation by commercial banks and understand the working of money multiplier.

CO5: Develop the ability to explain theories of Demand for Money- Classical Quantity Theory, Keynesian Theory, Baumol and Tobin's Contributions, Friedman's Restatement of Quantity Theory of Money.

CO6: Analyse Simultaneous Equilibrium and Tatonnement Process under closed and open economies and assess the relative effectiveness of Monetary and Fiscal Policies under different situations in IS-LM-BP Framework.

CO7: Identify the effects of Inflation and understand various theories of Inflation- Quantity Theory, Keynesian Theory, Monetarist views, Modern theory, Structural Theory of Inflation and illustrate short run and long run views of Philips Curve Analysis.

CO8: Analyze different phases of trade cycle and demonstrate various trade cycle theories- Hansen–Samuelson Accelerator–Multiplier Interaction Model, Hicks Model, Kaldor Model and Goodwin model of endogenous cycles.

CO9: Gain knowledge about the New Classical School, the Random Walk of GDP, Real Business Cycle Model and the New-Keynesian School of Macroeconomics.

MA Economics (Semester I and II)

Course: Quantitative Methods

After successfully completing this course, students will be able to:

CO1: Understand and apply the knowledge of matrices and determinants in significant business and economic problems.

CO2: Gain knowledge about solving equations and system of equations.

CO3: Determine and study the changes that occur in a variable when other variables on which it depends changes.

CO4: Apply the knowledge of technique of maximization and minimization in business problems like maximizing revenue and profits, minimizing costs etc.

CO5: Understand the basic statistical tools useful in day-to-day decision making which aids businesses.

CO6: Investigate and draw inferences from the available data and aid further conclusions.

CO7: Use the concept of time series to measure changes in values of data caused by regular and irregular changes over time.

CO8: Measure relative changes in phenomena like price, cost of living, national income at different points of time.

CO9: Use the powerful qualitative techniques like statistical techniques and operations research techniques for solving various decision-making problems of business and industry.

CO10: Use the theory of probability in the field of statistics, economics, commerce and social sciences to make predictions in the face of uncertainty.

CO11: Apply the technique of linear programming to determine optimal allocation of limited resources to meet the given objectives.

CO12: Use the statistical techniques of interpolation and extrapolation to find out relevant missing or unknown values in a given series.

CO13: Understand and measure the extent of closeness of the relationship between two or more variables using the concept of correlation.

CO14: Estimate the value of a dependent variable on the basis of the given value of the independent variable using regression analysis.

MA Economics (Semester I)

Course: International Economics

After successfully completing this course, students will be able to:

CO1: Describe international economics of open economies and international trade flows among various countries.

CO2: Evaluate theories related to international trade for profit maximization.

CO3: Analyse process of gains from trade and determination of terms of trade.

CO4: Describe concept of balance of payments and measures to correct deficit in Balance of payments.

CO5: Assess trade policy and concept related to trade policy like quotas, tariffs and exchange rates.

CO6: Interpret India's foreign trade, policy and its participation in international trade organisations like World Trade Organizations.

CO7: Demonstrate measures to promote exports and regulation of foreign trade in India.

CO8: Analyse nature and functions of organizations related to regional cooperation in trade.

MA Economics (Semester II)

Course: Public Finance

After successfully completing this course, students will be able to:

CO1: Describe role of Government in an economy and way to maximum social advantage in view of Dr Dalton.

CO2: Describe sources of income, types and principles of expenditures of Government and general importance of Public finance.

CO3: Analyse public expenditure in India and effects of current trend of growth in Public expenditure.

CO4: Analyse concepts and principles related to public revenue, taxation and status of Indian taxation.

CO5: Examine external and internal debts of Government and ways to repay public debts.

CO6: Illustrate concepts of budgeting and Indian budgeting with special reference to gender budget.

CO7: Describe purpose and process of deficit financing in economy and trends in deficit financing in India.

CO8: Describe federal finance in India and problems related to centre and state financial relationship.

M.A.II (Semester III & IV)

Course: Economics of Growth and Development

After successfully completing this course, students will be able to:

CO1: Understand ways to explore and exploit linkages among primary, secondary and tertiary sector for ensuring faster economic development.

CO2: Gain knowledge of relationship between economic growth and income distribution along with ways to maintain the right balance.

CO3: Develop in depth knowledge of core values of development and its various measures.

CO4: Evaluate role of government in the overall development process and poverty alleviation.

CO5: Develop understanding of types and effects of international capital flows.

CO6: Critically examine various models of Development and their relevance to less developed nations.

CO7: Evaluate different strategies of economic growth and their suitability to present needs and time.

CO8: Evaluate different investment criteria for a project and make right choice of technique.

CO9: Gain knowledge of dynamics of international trade and its effect on less developed countries.

MA II (Semester III & IV)

Course: Indian Economic Issues

After completing this course, the students will be able to:

CO1: Explain the economy of India during pre-reform and post reform period

CO2: Describe the appraisal of Economic Reforms Programme

CO3: Explain the Occupational structure of India

CO4: Describe the pattern of growth and structure of Indian Agriculture

CO5: Explain the different industrial policy initiatives

CO6: Explain the problems and suggestions for poverty and unemployment in India

CO7: Explain the importance of infrastructure development in India

CO8: Describe special economic zones

CO9: Describe Indian money and capital markets

CO10: Explain SEBI

CO11: Explain fiscal imbalances and public debt sustainability in India

CO12: Describe liberalised exchange rate management system

MA Economics (Semester III & IV)

Course (Option I): Economics of Agriculture

After successfully completing this course, students will be able to:

CO1: Understand specificities of farm organization, agricultural production and markets.

CO2: Identify and utilize backward and forward linkages of agriculture in various business situations.

CO3: Understand dilemmas of Development

CO4: Gain knowledge on production functions and production relations in agriculture.

CO5: Explain sources and barriers to agricultural development

CO6: Build understanding of models of agricultural development and their relevance to less developed nations.

CO7: Assess risks and uncertainties in agriculture.

CO8: Make an assessment of peculiar characteristics and trend in demand and supply of agricultural products.

CO9: Understand issues related to agricultural finance and rural credit markets.

CO10: Evaluate food security issues and policy measures by the state.

CO11: Gain knowledge of issues involved in external trading of agricultural goods.

CO12: Build theoretical and practical knowledge regarding issues involved in agricultural marketing.

CO13: Get exposed to recent developments in Indian agriculture.

CO14: Analyse and critically assess issues, policies and programmes associated with agriculture.

MA Economics (Semester III & IV)

Course (Option V): Econometrics

Successful completion of this course will enable students to -

CO1: Apply economic theory with greater understanding of economic relationships and relevant statistical methods.

CO2: Understand applied economic relationships for meaningful research in economics.

CO3: Understand relevant applications of econometric methods of analysis.

CO4: Make estimation of both single and simultaneous equation models.

CO5: Understand types of data used in Econometric Models.

CO6: Undertake testing of hypothesis along with Maximum Likelihood Estimation (MLE).

CO7: Handle problems relating to Multicollinearity, Heteroscedasticity and Autocorrelation.

CO8: Undertake Testing of Specification and Misspecification

CO9: Develop understanding of Encompassing and Non-Encompassing Models

CO10: Understand simultaneous Equations Models and Panel Data Models

MA Economics (Semester III)

Course (Option VII): Economics of Population

Successful completion of this course will enable students to -

CO1: Critically examine various theories of Population along with greater understanding of demographic dynamics.

CO2: Understand relationship between Population and Economic Development.

CO3: Analyse the Impact of Population Growth on Age and Gender Structure of Population.

CO4: Develop knowledge concerning Fertility and Mortality Differentials in India

CO5: Understand Causes and Consequences of Migration along with Rural-Urban and Male-Female Migration Differentials in India.

CO6: Equip themselves with knowledge of Sampling Vital Registration Methods.

CO7: Evaluate Population Policy of India since Independence.

MA Economics (Semester IV)

Course (Option VII): Economics of Money and Banking

Successful completion of this course will enable students to -

CO1: Understand Balance sheet of a Central Bank and Components of Money Supply.

CO2: Develop knowledge regarding process of Money Creation by the Banks.

CO3: Understand Money Supply and liquidity dynamics in India.

CO4: Critically examine theories of demand for money.

CO5: Equip themselves with understanding of term structure of interest rates

CO6: Understand monetary policy tools and monetary policy of RBI including money aggregates targeting, interest targeting and inflation targeting approaches of RBI.

CO7: Develop information about European Monetary System and constituents of international money and capital markets.

M.Com. Programme

Programme Outcomes

PO1: Students will be able to learn depth knowledge of commerce.

PO2: Trained the students' well-acquainted regarding current financial structure.

PO3: Students will apply concepts used in commerce for business decision making in a global economic environment.

PO4: Students will critically conduct research and evaluate research finding in the area of commerce.

PO5: Develop the skills of applying concepts used in commerce for right decision making in routine.

PO6: Develop competence with their usage in managerial decision making and control

PO7: Aware the internal and external effects in developing business strategy.

PO8: Inculcated students to acquire sound knowledge, concept and structure of capital market and financial services.

PO9: Criticize the business ethics and professional values in running business.

PO10: Students gain ability to solve problems relating to Company Accounts, Valuations and special types of situations.

PO11: Equip the students with advanced knowledge of techniques and methods of planning and executing the management audit.

PO12: Develop team work, leadership and managerial skills.

Programme Specific Outcomes

PSO1: Students will be able to apply basic skills learnt in commerce necessary for analysis of various problems in management accounting, strategic management and Production & Operation Management.

PO2: Students will able to demonstrate quantitative and qualitative knowledge in key areas of Industrial Economics and Human resource management.

PSO3: Students will able to deal with macro environment in which a business organization operates.

PSO4: Student will be capable of analyzing the macroeconomic policies of the government and assess their impact on business.

M.Com. (Semester I)

Course: Managerial Economics

After completing this course, the students will be able to:

CO1: Understand the concepts and techniques used in Micro-economic theory.

CO2: Apply this knowledge in business decision making.

CO3: Understand the changes in the nature of business firms in the context of globalisation.

CO4: To decide on the planning and control of the benefits.

CO5: Apply the economic theory in administrative decision making.

CO6: Understand the production theory and production decision.

CO7: Understand the product planning and market structures.

CO8: Identify all the important factors that affect a firm and industry.

CO9: Analyse number of issues relevant to businesses that are based on economic thinking or analysis.

CO10: Make good decisions by providing information on waste associated with a proposed decision.

M.Com (Semester II)

Course: Business Environment

After completing this course, the students will be able to:

CO1: Understand the set of external factors such as the economic, socio-economic, government and legal factors, demographic factors etc which are uncontrollable in nature and affect the business decisions of the company.

CO2: Understand the dynamism of business policy.

CO3: Identify the various environmental factors and their relevance to particular industry.

CO4: Explain the importance of ethics in business.

CO5: Analyse the growth of management, education and training and how it has contributed to the growing professionalism of management and social orientation of business.

CO6: Importance of environment study

CO7: Check the factors to be considered for environmental scanning.

CO8: Understand the main objectives of Economic Policy and how far these objectives have been fulfilled till date.

CO9: Analyse the beneficial and harmful aspects of MNCs and how the government is trying to have control over them.

CO10: Review India's Fiscal and Monetary Policy.

PG DEPARTMENT OF ENGLISH

2.6.1 Program outcomes, program specific outcomes, and course outcomes for all the programs offered by the institution are stated and displayed in the website of the institution.

Programme Outcomes:

In addition to BA, the Department also offers compulsory English courses for classes BSc (Medical, Non-Medical, and Computer Science), BCA, BCom. After successfully completing English Programme students will be able to:

PO1: **Knowledge:** Students will widen their knowledge of the history of the various Periods and Movements in English Literature. They will get acquainted with poems, dramas and novels of various important writers of English Literature and Indian Literature. It aims to familiarize the students with the theories, approaches, methods, and specific techniques concerning the teaching of English literature and language.

PO2: **Effective Communication:** Students will be able to use English language with ease, read fluently and enrich their vocabulary. Their Proficiency in communicating in English will increase and their ability to think critically, speak articulately, write lucidly and precisely, and to read powerfully, deftly, and with understanding of subtleties and nuances.

PO3: **Critical Insight:** The students will be able to understand a literary text in different contexts, and acquire an awareness of socio-political and economic conditions of the society from different periods. They will develop an ability to read texts in relation to their historical and cultural contexts, in order to gain a richer understanding of both text and context.

PO4: **Reading:** Students will become accomplished, active readers who appreciate ambiguity and complexity, and who can articulate their own interpretations with an awareness and curiosity for other perspectives.

PO5: **Writing Skills:** Students will be able to write effectively for a variety of professional and social settings. They will practice writing as a process of motivated inquiry, engaging other writers' ideas as they explore and develop their own. Students will be able to prepare, organize, and deliver an engaging oral presentation.

PO6: **Cultural and Historical Awareness:** It will enable the students to analyze literature and fiction using appropriate theoretical, historical, and cultural apparatus. Students get to know various cultures and the construction of gender, nation and race throughout history.

PO7: **Passion for the subject:** Students will develop a passion for literature and language. They will appreciate the expressive use of language as a fundamental and sustaining human activity, preparing for a life of learning as readers and writers.

Programme Specific Outcomes:

PSO1: The students develop their ability to critically analyse Literature texts of different eras and be able to interpret and review them.

PSO2: The programme seeks to foster the intellectual development of its students by encouraging study of literature and writing. The issues of culture, history, gender, race, ethnicity, politics are addressed and negotiated in the process of imparting knowledge of English literature in its pluralistic forms, to help students develop a critical mindset of their own.

PSO3: The students will improve their communications skills and effectively interact in various social situations like interviews, seminars, group discussions etc.

COURSE OUTCOMES

COURSE: COMPULSORY ENGLISH (B.A. I, II, III)

After successfully completing this course the students will be able to:

CO1: Read a variety of texts critically

CO2: Summarize a poem and recite lines from it

CO3: Identify parts of speech

CO4: Increase their vocabulary

CO5: Develop the knowledge of grammar of the English language

CO6: Enhance their four skills of Listening, Speaking, Reading and Writing

CO7: Develop their overall confidence and personality

COURSE: ELECTIVE ENGLISH (B.A. I, II, III)

After successfully completing this course the students will be able to:

CO1: Do a close reading of literary texts and rhetoric.

CO2: Increase knowledge of the genres of fiction, poetry, and drama

CO3: Understand various genres of literature along with the usage of literary devices.

CO4: Understand distinctive features of novels, short fiction and prose essays

CO5: Identify a variety of forms and genres of poetry from diverse cultures and historic periods, such as sonnets, ballads, dramatic monologues, epic and pastoral, free verse, Elegy etc

CO6: Recognize the rhythms, metrics and other musical aspects of poetry.

CO7: Expands the knowledge of the students about the major writers and their works in English Literature and Indian Literature.

CO8: Prepare for postgraduate programs such as M.A. English.

COURSE: ENGLISH HONOURS (B.A. II, III)

After successfully completing this course the students will be able to:

CO1: Develop a holistic understanding of literature from the 16th century to the 20th century.

CO2: Examine the themes and structures of drama, fiction, non-fiction and poetry

CO3: Learn the relevant literary terms through exposure to various texts from across the literary ages.

CO4: Preview the history of English literature from Old English times to the Modern period, with particular reference to the major literary movements and authors

CO6: Gain in-depth knowledge of English Literature and promote further research in the area.

CO7: Prepare for postgraduate programs such as M.A. English and other entrance examinations.

CO8: Provides an additional asset to the students along with their BA degree.

COURSE: Compulsory English (**B.COM. (I), B.C.A. (I), B.Sc. (II))**

After successfully completing this course the students will be able to:

CO1: Read a variety of texts critically

CO2: Recognize the themes of prose and drama

CO3: Define verbal, non-verbal and modern forms of communication

CO4: Compose and draft letters, reports, advertisements, tenders etc

CO5: Increase their vocabulary

CO6: Enhance their four skills of Listening, Speaking, Reading and Writing

CO7: face interviews, group discussions and increases their capability of acquiring jobs in different fields

CO8: meet the challenges of the modern competitive society

CO9: Develop their overall confidence and personality

MA English

Programme Outcomes:

After successfully completing M.A. English Programme students will be able to:

PO1: **Knowledge and Understanding**: It will widen the knowledge of the students about the history of the various Periods and Movements in English Literature.

PO2: **Literature in diversity**: The scope of this programme is quite expansive. It provides literature not only from English language but also English translations of literary texts written in Indian languages like Punjabi, Hindi Urdu etc.

PO3: **Theoretical framework**: It aims to familiarize the students with the theories, approaches, methods, and specific techniques concerning the teaching of English literature and language.

PO4: **Fluency and Word Power**: Students will be able to use English language with ease, read fluently and enrich their vocabulary.

PO5: **Literature, History and Society**: The students will be able to understand a literary text in different contexts, and acquire an awareness of socio-political and economic conditions of the society from different periods. They will develop an ability to read texts in relation to their historical and cultural contexts, in order to gain a richer understanding of both text and context.

PO6: **Multiple Perspectives and Interpretation**: Students will become accomplished, active readers who appreciate ambiguity and complexity, and who can articulate their own interpretations with an awareness and curiosity for other perspectives.

PO7: **Writing and Presentation**: Students will be able to write effectively for a variety of professional and social settings. They will practice writing as a process of motivated inquiry, engaging other writers' ideas as they explore and develop their own. Students will be able to prepare, organize, and deliver an engaging oral presentation.

PO8: **Critical and Analytical Skills**: It will enable the students to analyse literature and fiction using appropriate theoretical, historical, and cultural apparatus. Students get to know various cultures and the construction of gender, nation and race throughout history.

PO9: **Literature and Life**: Students will develop a passion for literature and language. They will appreciate the expressive use of language as a fundamental and sustaining human activity, preparing for a life of learning as readers and writers.

Program Specific Outcomes

PSO1. Students will be able to understand the essential value of criticism in language and literature.

PSO2. Students will read many pieces of literary excellence from across different languages and cultures.

PSO3. It will widen students' perspective and make them more receptive towards different interpretations and opinions.

PSO4. The Programme will make them more familiar with the language and its complex structures.

Course Outcomes: MA I

Paper II: Literary Movements I

After passing this paper, students will be able to:

CO1: Identifies some of the major literary movements of English literature, such as classicism, romanticism or realism.

CO2: Develop a critical thinking, and have an acute understanding of literary history and literary criticism.

CO3: Understand the process of literary periodisation.

CO4: Have a comprehensive knowledge of different periods of English literature.

Paper II: Approaches to Literary Criticism I

After passing this paper, students will be able to:

CO1: Identify and understand various approaches to Literary Criticism, such Historical Approach, Mythological Approach, Psychological Approach, Formalist Approach etc.

CO2: Equip themselves with a knowledge of key forms and terminology of literary criticism.

CO3: Understand basic theoretical concepts underlying contemporary approaches to literature and the major differences between them.

CO4: Apply these different approaches of Literary Criticism on literary texts.

CO5: Widen their understanding of interpretation and creative process.

Paper III: British Literature I

After passing this paper, students will be able to:

CO1: Have an overview of English literature written during initial periods of English Literature.

CO2: Identify and characterise the English literature written during the period 1500-1660, that covers Renaissance, Reformation and Restoration times of English literature.

CO3: Understand the Protestant Reformation and its impact on English literature.

CO4: Know about the trends, ideas, poetic forms and genres prevalent during this period.

Paper IV: British Literature II

After passing this paper, students will be able to:

CO1: Characterise English literature written from the end of eighteenth century to the mid of nineteenth century, that majorly covers the Romantic Period.

CO2: Identify and analyse prominent writers and writings of Romantic Period.

CO3: Understand the cultural and literary shift from objectivism to subjectivism.

CO4: Know about the trends, ideas, poetic forms and genres prevalent during this period.

Course Outcomes: MA II

Paper I: Critical Theory

After passing this paper, students will be able to:

CO1: Have an in-depth knowledge of the core texts representing literary theory post 1960.

CO2: Identify major strands of modern literary theory and develop an understanding of the function and practice of modern literary and cultural theory.

CO3: Understand the historical progression of literary analysis as well as the ideological impulses that have modified the practice of literary studies.

CO4: Widen their critical and analytical approach so as to understand the representational politics of literary texts.

Paper II: Shakespeare I

After passing this paper, students will be able to:

CO1: Gain an insight into the works of Shakespeare and the glory of Shakespearean the playwright, whose plays and sonnets 'please all and please always'.

CO2: Read some of the re-written plays of the great playwright along with the original ones.

CO3: To contextualise Shakespeare in the modern times.

CO4: Analyse the multiple interpretations of his plays and to re-contextualize his plays in alternative ways.

Paper III: Postcolonial Literature

After passing this paper, students will be able to:

CO1: Examine some of the key concepts and debates in Postcolonial writing, theory and criticism.

CO2: Identify and analyse major assumptions, contexts and pitfalls of postcolonial studies.

CO3: Understand the shift to self-representations, resistance, postcolonial activism and theories of language and nationalism.

CO4: Know the present/past situations and circumstances of once colonised countries and how it affected their life, culture and literature.

Paper IV: Writings from Punjab

After passing this paper, students will be able to:

CO1: Equip themselves with literary creations that emerged from or became an important part of the literary history of Punjab.

CO2: Read and analyse the works of several literary stalwarts like Guru Nanak Dev, Guru Gobind Singh, Kabir, Baba Farid, Bulleh Shah and a few others.

CO3: Have an in-depth knowledge of the modern literature encompassing regional concerns of Punjabi culture in particular - Partition Literature, Feminism, Dalit Literature, Progressive Writings and Diaspora.

CO4: Visualise the significance of regional Indian literature in the whole gamut of Indian literature.

Paper V: Research Methods

After passing this paper, students will be able to:

CO1: Understand the increasing importance of research for master's students in the emerging contexts.

CO2: Have a basic understanding of Research tools and techniques, research ethics, research theory, online/print sources and documentation.

CO3: Learn the theoretical aspects of research as well as their practical applicability.

CO4: Grasp the importance of good and ethical research and its contribution to literature and society.

Paper VI: Creative Writing and Soft Skills

After passing this paper, students will be able to:

CO1: Know about the finer aspects of creative writing, translation and other soft skills.

CO2: Observe the contemporary emphasis on the practical applications of ideas related to the use of language in different situations.

CO3: Sharpen their skills of creative writing creatively,

CO4: Identify and analyse the nuances of Translation and its literary process.

DEPARTMENT OF HINDI

1	Hindi (Elective)	• Understand the basic concept and subject of Hindi & its origin. • Understanding the features of Adikal in context of socio - cultural and political condition of that period. • Describing the progressive nature of sant Kabir, Nanak and Ravidas through their writings. • To able to understand 'Kavitalok' by Shiv Kumar Sharma. • To able to understand 'Sajeev Kahaniyan' by Dr Lakshmi Chandr Khurana.
2	Hindi (Elective)	• Importance of subject Hindi & its Branches. • Understanding the features of Bhakti kal in context of socio - cultural and political condition of that period. • Describing the krishna leela poetry of Soordas by relating it with his philosophy of his life. • Through 'Jhansi ki Rani' by Vrindavan Lal Verma, Hindi Biographical Novels students can understand our rich culture and heritage. • To able to understand 'Kavitalok' by Shiv Kumar Sharma.
3	Hindi (Elective)	• Understand various aspect of Hindi literature with a process to reach method and giving new mode and direction. • Understanding the features of Ritikal in context of socio - cultural and political condition of that period. • To able to understand 'Tarangini' by Manohar Lal Aanand.
	Hindi (Honours)	• Different area and theory such as vocabulary and vice versa. • To able to understand 'Kavitavali' by Tulsidas. • To able to understand 'Bharat-Bharti' by Mathali Sharan Gupt.
4	Hindi (Elective)	• Know about Hindi literature its roots cause perspectives and methods. • Understanding the features of Adhunikkal in context of socio - cultural and political condition of that period. • To able to understand 'Aadarsh Ekanki Sangrah' by Dr Sansaar Chand. • To able to understand 'Tarangini' by Manohar Lal Aanand.
	Hindi (Honours)	• Elaborating and understanding its philosophical methods of Hindi Literature. • To able to understand 'Lahar' by Jayshankar Prasad.
5	Hindi (Elective)	• Evaluating the concept of Hindi from past to present and making the society more closely through literature. • To able to understand 'Kurukshetra' by Ramdhari Singh Dinkar. • Learn about the definition and distinction of poetry like Mahakavya aur Khand-kavya.
	Hindi (Honours)	• To able to understand 'Kahaniyan' by Bhisham Sahni. • To able to understand 'Ateet ke Chalchitra by Mahadevi Verma. • To able to understand Shabd-Shaktiyan, Ras, Bimb and Prateek.
6	Hindi (Elective)	• To able to Analyse the development of Devnagri script Hindi. • To able to understand 'Gadhya Phulwari' by Dr ShahabuDin Shaikh. • Origin and development of Hindi Nibandh, Upnyas, Kahani, Sansamran, Aatmkatha, Rekhachitra and Jivani. • To able to understand Chhand.
	Hindi (Honours)	• To able to understand 'Ek Kanth Vishpayi' by Dushyant Kumar. • To able to Analyse the development of Devnagri script Hindi. • To able to understand the different flows of Hindi language (Rajbhasha, Bolibhasha). • To able to understand Chhand and Alankar.

DEPARTMENT HISTORY

History (Honor's and General)

The scope of the discipline of History has widened and the idea that History primarily deals with the glories of the by-gone dynasties has become redundant. The present History encompasses the people and their environment, men, and women and their mentalities, society, polity and economy. Thus we have Social History, Economic History, Political and Military History, Cultural History, History of Ideas and mentalities, History of institutions, Political Bodies and practices .History, therefore, does not merely deal with the conglomeration of discrete facts, but it attempts to arrive at a conclusion verifying the authenticity of the facts and thus understand the social and Political processes of the present on the light of the past events. Since the horizon of the discipline has extended a lot, a student or a teacher's role has become quite challenging.

The course that we teach our undergraduate students aims to inculcate the following among the students:

CO1. Know the "meaning of history", a meaning that includes the varied nations, their people and their rulers.

CO2. Know the nation's past- its glories and fallacies and thus to form a logical connection between the present and the past.

CO3. To explain much of the present social practices by knowing their proper context.

CO4. To the basic tools of the Historical analysis, in order to trace back known historical facts-things they have learned in school- to the sources of information.

CO5. To inculcate in the pupil a respect for nation's heritage and its preservation.

CO6. To develop critical research aptitude among the students and enable them for higher studies.

POST GRADUATE DEPARTMENT OF MATHEMATICS

Programme Name: BA/BSc (Mathematics*)

* Mathematics as one of the subjects in the BA, BSc undergraduate degree programmes.

Programme Outcomes of BA/BSc (Mathematics*)

After completing BA/BSc (Mathematics*) programme, the students will be able to:

PO 1: Think and analyse the mathematical formulations critically.

PO 2: Become familiar with the appropriate tools and methods to attempt basic and advanced problems in the core mathematical disciplines.

PO 3: Pursue higher degree programmes in the subject.

PO 4: Develop problem solving strategies in real life problems.

Programme Specific Outcomes of BA/BSc (Mathematics*)

PSO 1: Enables the students to apply the fundamental concepts imbibed and tools learnt in the curriculum to critically examine, model and investigate the solutions of basic and advanced problems in the specific theoretical and applied mathematical core areas.

PSO 2: Motivate students for pursuing research career in mathematics and allied disciplines.

PSO 3: Constructing concrete foundations on abstract and application oriented courses for academic enrichment.

Programme Name: BA/BSc (Mathematics*)

Course Outcomes

F.Y.BA/BSc (Mathematics*) (SEM – I)

Paper - I: Course: Plane Geometry

After successfully completing this course, the students will be able to:

CO 1: Transform the equations by shifting of origin, rotation of axes in 2 dimensions.

CO 2: Transform the given equation to a new equation in which the linear terms, mixed terms are absent. Explain about the invariant terms in 2 dimensional transformations.

CO 3: Find out the joint equation of two straight lines, angle between them, condition of parallelism and perpendicularity, joint equations of angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve.

CO 4: Describe about the general equation of circle and can find circle through the intersection of two lines, tangents, normals, chord of contact, pole and polar , pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality, power of a point w.r.t. circle, radical axis, co-axial family of circles, limiting points.

CO 5: Know about the general equations of a conic :- parabola, ellipse and hyperbola and are able to find tangents, normals, chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of mid-point, diameter and their special properties.

CO 6: Compute the conjugate diameters of ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

CO 7: Identify the conics in general second degree equations.

Paper - II: Course: Calculus – I

After successfully completing this course, the students will be to:

CO 1: Understand the Real number system and the associated properties.

CO 2: Learn about the concept of bounds, greatest lower bound and least upper bound.

CO 3: Know about the concepts of neighbourhood of a point, limit, continuity and differentiability, types of discontinuities, composite functions.

CO 4: Learn about hyperbolic functions and inverse hyperbolic functions and derivatives.

CO 5: Discuss Leibnitz theorem and application in evaluating higher order derivatives.

CO 6: Understand general mean value theorems - Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's theorem, Maclaurin's expansion along with applications.

CO 7: Discuss the concept of indeterminate forms and application of L'Hospital rule to evaluate the limits.

Paper - III: Course: Trigonometry and Matrices

After successfully completing this course, the students will be able to:

CO 1: Explain and use the application of De Moivre's theorem in various functions of complex variables.

CO 2: Describe the types of matrices like Hermitian , Skew Hermitians etc and their different forms.

CO 3: Calculate the rank of different types of matrices and its use to solve the system of homogeneous and non-homogeneous equations.

CO 4: Calculate the eigen values and eigen vectors, diagonalizable matrices and the inverse of a matrix by Cayley Hamilton theorem.

F.Y. BA/BSc (Mathematics*) (SEM – II)

Paper - I: Course: Solid Geometry

After successfully completing this course, the students will be able to:

CO 1: Transform the equations by shifting of origin, rotation of axes in 3 dimensions using the basic knowledge of d- ratios and d- cosines.

CO 2: Explain the section of a sphere and a plane and can find the spheres through a given circle, intersection of a line and a sphere, tangent line, tangent plane, angle of intersection of two spheres and condition of orthogonality, power of a point w.r.t. a sphere, radical axis, radical center, co-axial family of spheres, limiting points.

CO 3: Describe cylinder and its different kinds. Can find the equation of right circular, elliptic, parabolic, hyperbolic cylinders and standard form.

CO 4: Understand the concept of enveloping cylinders and can find their equations.

CO 5: Describe homogeneous equations, cone, its generator and can determine the equation of a cone with a vertex at the origin, standard form, quadric cone through the axes, right circular and elliptical cones whose vertex and conics for base is given.

CO 6: Explain and derive equations of enveloping cones, reciprocal cones.

CO 7: Find the equation of tangent plane to the cone, intersection of a straight line and a cone, angle between two lines in which a plane cuts the cone, condition that a cone have three mutually perpendicular generators.

CO 8: Explain coincides, equations of ellipsoid, hyperboloid and paraboloid in standard form. Reduce the general equation of second degree in three variables in standard form.

Paper - II: Course: Calculus – II

After successfully completing this course, the students will be able to:

CO 1: Discuss concavity, convexity, multiple points, asymptotes.

CO 2: Trace Cartesian and parametric Curves.

CO 3: Solve the integration problems using hyperbolic functions.

CO 4: Explain the reduction formulae and the connection with integrals.

CO 5: Approximate value of a definite integral by using numerical Integration.

CO 6: Discuss the concepts associated with series and summation of series.

CO 7: Discuss the concepts of length, area, volume of a curve and their computation by the application of suitable methods.

Paper - III: Course: Theory of Equations
After successfully completing this course, the students will be able to:

CO 1: Define the terms gcd, lcm of polynomials.
CO 2: Apply factor theorem, remainder theorem to calculate remainder.
CO 3: Explain the relationship between roots and coefficients of n degree polynomials.
CO 4: Solve the cubic equations by Cardon method and bi-quadratic equations by Descarte's and Ferrari's method with the help of transformations.
CO 5: Explain the nature of roots by Descarte's Rule of sign and approximation of roots by Newton's method.

S.Y. BA/BSc (Mathematics*) (SEM - III)

Paper - I: Course: Advanced Calculus – I

After successfully completing this course, the students will be able to:

CO 1: Describe the concepts and solve the problems of multivariable calculus.

CO 2: Analyze and draw diagrams for solving examples of multivariable calculus.

CO 3: Calculate limit, continuity and differentiability of functions in two or three variables, partial derivatives, maxima and minima with Lagrange's method.

CO 4: Calculate the Jacobians and its use in finding double and triple Integrals.

CO 5: Calculate involute, evolute and family of curves.

Paper - II: Course: Differential Equations – I

After successfully completing this course, the students will be able to:

CO 1: Explain exact differential equations and can derive its necessary and sufficient condition for exactness, its rules and by using rules they are able to solve the given differential equations of first order.

CO 2: Solve the first order and higher degree equations by different methods as solvable for x, y,p and by reducing given equation to Clairaut's form.

CO 3: Explain and derive both primitive and singular solutions by finding c discriminant and p discriminant.

CO 4: Find the orthogonal trajectories of given equations by both Cartesian and polar coordinates.

CO 5: Solve the linear equations with constant coefficients by five standard cases of particular integrals and some typical problems.

CO 6: Solve the linear differential equations with variable coefficients- Cauchy and Legendre equations, linear differential equations of second order- transformation of the equation by changing the dependent variable/the independent variable, methods of variation of parameters and reduction of order.

CO 7: Solve simultaneous Differential Equations.

Paper - III: Course: Statics

After successfully completing this course, the students will be able to:

CO 1: Recall Newton's Laws of motion. Discuss the concepts of coplanar forces, non-coplanar forces, concurrent forces, non-concurrent forces and their resultant. Apply parallelogram law of forces and calculate the resultant of two forces acting at a point.

CO 2: Discuss analytical methods to find component of a force, resultant of more than two forces, Discuss equilibrium and apply Lami's theorem. Describe necessary and sufficient condition for equilibrium of a number of coplanar concurrent forces and computation of the resultant.

CO 3: Discuss non - concurrent forces, Varignon's theorem and its applications, parallel forces, resultant of parallel forces, couples, moment , equilibrium, equivalence, behaviour in parallel planes.

CO 4: Discuss the m-n conditions, equilibrium of three and more coplanar forces and the methods of evaluation (resolved parts, moment of force). Discuss the concepts of friction, its different stages.

S.Y. BA/BSc (Mathematics*) (SEM - IV)

Paper - I: Course: Advanced Calculus – II

After successfully completing this course, the students will be able to:

CO 1: Explain sequential continuity and uniform continuity.

CO 2: Define sequences, bounded sequences, monotonic sequences, Cauchy sequences and their convergence or divergence.

CO 3: Use the tests of convergence of infinite series like Leibnitz's test, Root test, Ratio test, Comparison test, Cauchy's Integral test, Raabe's test and Gauss test etc.

CO 4: Rearrangement of convergent series.

Paper - II: Course: Differential Equations – II

After successfully completing the course, the students will be able to

CO 1: Explain power series, analytic functions, ordinary and singular points and can use power series method, Frobenius method to solve the differential equations in series.

CO 2: Know about Bessel functions of first and second kind, Legendre function, generating functions, recurrence relation and orthogonality of Bessel and Legendre function.

CO 3: Explain partial differential equations. Form partial order differential equations by eliminating arbitrary constants and arbitrary functions, solve the partial order differential of first order.

CO 4: Find the integral surfaces passing through a given curve, surfaces orthogonal to a given family of surfaces.

CO 5: Explain Laplace transformation, linearity, existence theorem for Laplace transformations, shifting theorems, Laplace transforms of derivatives and integrals, multiplication of t^n, division by t and find the Laplace transformation of a given function.

CO 6: Explain the inverse Laplace transforms, its linearity property, shifting properties, change of scale property, inverse Laplace transforms of derivatives and integrals, Convolution theorem.

CO 7: Discuss applications of Laplace transforms by solving integral - differential equations, differential equations with constant coefficients and variable coefficients and solve the simultaneous ordinary differential equations.

Paper - III: Course: Dynamics

After successfully completing this course, the students will be able to:

CO 1: Discuss rectilinear motion with constant acceleration, diagramatic relations between velocity and time, effect of gravity on motion, Newton's laws of motion, Atwood machine and the computation of tension, pressure and description of motion.

CO 2: Discuss rectilinear motion with variable acceleration, concepts such as escape velocity, motion under gravity, rectilinear motion with variable acceleration.

CO 3: Discuss periodic motion, SHM, motion of horizontal and vertical elastic string, curvilinear motion, projectiles, trajectories, centripetal force, motion of celestial bodies

CO 4: Describe the concepts of work, power, energy and applications, concept of relativity, moment, impulse and impact of collision on elastic and non elastic bodies.

T.Y. BA/BSc (Mathematics*) (SEM – V)

Paper - I: Course: Analysis - I

After successfully completing this course, the students will be able to:

CO 1: Learn about countable sets, Riemann integration, beta and gamma functions and their applications.

CO 2: Discuss improper integrals and their convergence, integrals as functions of a parameter and Frullani integral.

Paper - II: Course: Modern Algebra

After successfully completing this course, the students will/ will be able to:

CO 1: Gain knowledge about groups, subgroups, cyclic groups, permutation groups, normal and quotient groups. Explain the notion of cosets, coset properties, Lagrange's theorem, Cauchy's theorem, Cayley's Theorem, direct products, conjugacy and class equation, simplicity of A_n, n > 4 along with various applications.

CO 2: Describe group homomorphisms, isomorphism theorems, the associated properties and interesting applications.

CO 3: Understand ring theoretic concepts - integral domains, subrings and ideals, characteristic of a ring, prime and maximal ideals, quotient rings and fields and explain ring homomorphisms, isomorphism theorems, polynomial rings.

Paper - III: Course: Probability Theory

After successfully completing this course, the students will be able to:

CO 1: Describe and apply different type of distributions in the field of science and technology, medical industries and in the real life situations.

CO 2: Learn the importance of sampling theory while investigating different types of polls during elections.

CO 3: Use various types of graphs and histograms.

T.Y. BA/BSc (Mathematics*) (SEM – VI)

Paper - I: Course: Analysis - II

After successfully completing this course, the students will be able to:

CO 1: Learn about double and triple integrals and their applications, vector integration, Gauss, Green and Stoke's theorems.

CO 2: Describe sequences and series of functions and their pointwise and uniform convergence, power series and Fourier series.

Paper - II: Course: Linear Algebra

After successfully completing this course, the students will/ will be able to:

CO 1: Gain knowledge about vector spaces, subspaces, linear independence and dependence of vectors, linear spanning, basis and dimension, direct sums and complements of vector spaces along with some interesting consequences.

CO 2: Understand and explain linear transformations, rank and nullity of a linear transformation, the process of change of basis, some associated properties, characteristic roots and characteristic vectors, algebraic and geometric multiplicity.

CO 3: Explain Cayley - Hamilton theorem, diagonalizable operators and matrices, minimal and characteristic polynomial of a linear operator (matrix) along with some applications.

Paper - III: Course: Numerical Analysis

After successfully completing this course, the students will be able to:

CO 1: Discuss various numerical methods for finding roots of the equations - bisection, secant, regula falsi, Newton's method. Interpolation - Lagrange and Hermite interpolation, divided differences, difference schemes.

CO 2: Learn the concept of numerical differentiation and describe numerical quadrature: Newton-Cote's Formulas, Gauss quadrature formulas, Chebychev's formulas.

CO 3: Learn the methods for solving algebraic and non-algebraic equations.

Programme Name: MSc (Mathematics)

Programme Outcomes of MSc (Mathematics)

After completing MSc (Mathematics) programme, the students will be able to

PO 1: Extend and generalize some classical results of interest, solve some intricate, abstract research problems and hence contribute as researchers in different fields of mathematics.

PO 2: Analyse nature of mathematics from cognitive to social perspective.

PO 3: Apply the mathematical knowledge imbibed towards data analysis efficiently.

PO 4: Develop need based mathematics teaching-learning resources.

PO 5: Explore research and development career opportunities.

PO 5: Develop competences like critical thinking, reasoning and problem solving strategies in real life situations.

Programme Specific Outcomes of MSc (Mathematics)

PSO 1: Induce abstract mathematical reasoning.

PSO 2: Comprehending the fundamental mathematical facts with academic rigour to promote new ideas in diverse disciplines.

PSO 3: Academic enrichment in diverse subjects in pure and applied mathematics, enabling the students to pursue higher degree programmes.

PSO 4: Effective mathematical curriculum and training empowers the students to prepare, compete and qualify various national level competitive examinations such as CSIR-JRF-UGC-NET, GATE.

PSO 5: Broaden the scope of pursuing research career in academic institutions and industry.

Programme Name: MSc (Mathematics)

Course Outcomes

F.Y. M.Sc. (Mathematics) (SEM - I)
Course: MATH - 601 S Real Analysis - I

After successfully completing this course, the students will be able to:

CO 1: Define countable and uncountable sets. Discuss metric spaces, compact sets, perfect sets, connected sets

CO 2: Explain the concept of convergent sequences in metric space, subsequences, Cauchy sequences.

CO 3: Define limit inferior and limit superior. Discuss limit, continuity and differentiability of functions.

CO 4: Discuss the existence of the Riemann- Stieltjes integral. Explain properties of the integral, integration of vector-valued functions, rectifiable curves.

CO 5: Solve problem of interchange of limit processes for sequences of functions. Discuss uniform convergence and describe the Stone-Weiestrass theorem.

Course: MATH - 602 S Algebra - I

After successfully completing this course, the students will/ will be able to:

CO 1: Gain knowledge about permutation groups, conjugacy and simplicity of A_n, n > 4, Cayley's Theorem, structure theory of finite groups - direct products, Sylow's theorems and their applications, the Fundamental Theorem for finite Abelian groups.

CO 2: Describe finite simple groups, the groups of order p^2 and pq (p and q primes) along with some interesting applications.

CO 3: Discuss the concept of solvable groups, normal and subnormal series, composition series, the theorems of Schreier and Jordan - Holder.

CO 4: Comprehend polynomial rings, formal power series rings, matrix rings and the ring of Guassian Integers, commutative rings in connection to quotient rings of polynomial rings factored by some appropriate ideals along with some interesting applications.

Course: : MATH - 603 S Differential Equations

After successfully completing this course, the students will be able to:

CO 1: Discuss the existence and uniqueness of solution of the first order differential equations. Gain knowledge of boundary value problems, Strum-Liouville theory and ODE in more than 2-variables.

CO 2: Explain partial differential equations of first order, partial differential equations of higher order with constant coefficients.

CO 3: Describe partial differential equations of second order and their classification.

Course: MATH - 604 S Complex Analysis - I

After successfully completing this course, the students will be able to:

CO 1: Learn Analytic functions, Cauchy-Riemann equations and harmonic functions

CO 2: Gain knowledge of Stereographic projection, power series and line integral

CO 3: Clear the concepts of Cauchy's theorem, Cauchy's integral formula and applications

CO 4: Know Morrera's theorem and Liouville's theorem.

Course: MATH - 605 S Number Theory - I
After successfully completing this course, the students will be able to:

CO 1: Define the divisibility, gcd, residue classes, Euler function, Legendre symbol, primitive roots and indices and binary quadratic forms.

CO 2: Describe Chinese remainder theorem, Fermat's theorm, Wilson theorem, Mobius inversion formula and Diophantine equations.

CO 3: Solve system of linear congruences and problems on Euler function, arithmetic functions, perfect numbers and Diophantine equations.

CO 4: Evaluate the problems on quadratic reciprocity law, sum of two and four squares and positive definite binary quadratic forms.

CO 5: Discuss the application of cryptography, fundamental theorm of arithmetic, special divisibility test.

F.Y. M.Sc. (Mathematics) (SEM - II)

Course: MATH - 621 S Real Analysis - II

After successfully completing this course, the students will be able to:

CO 1: Discuss the differentiation of vector valued functions and the space of linear transformations on R^n to R^m.

CO 2: Explain the Inverse function theorem and Implicit function theorem.

CO 3: Define measurable set , Lebesgue measure , non measurable set and measurable function, calculate outer measure of a set.

CO 4: Describe Littlewood's three principles. Explain Lebesgue integral of simple functions, bounded functions over a set of finite measure , non-negative measurable functions and explain the concept of general Lebesgue intergral and Convergence in measure.

CO 5: Discuss the differentiability of monotone functions, functions of bounded variation, absolute continuity and convex functions.

Course: MATH - 622 S Algebra – II

After successfully completing this course, the students will/ will be able to:

CO 1: Gain knowledge about factorization theory in integral domains, the notion of divisibility and associates, Unique Factorization Domains (UFDs), Principal Ideal Domains (UFDs), Euclidean domains (EDs) and their relationships along with some interesting consequences.

CO 2: Explain the notions of Noetherian and Artinian rings along with examples and counter examples, Artinian rings without zero divisors. Comprehend and explain the Hilbert basis theorem.

CO 3: Understand modules, the difference between modules and vector spaces. Explain module homomorphisms, quotient modules, completely reducible or semi - simple modules, free modules, flat modules.

CO 4: Describe the representation and rank of linear mappings, Smith normal form over a PID, finitely generated modules over a PID, rational canonical form and discuss the applications to finitely generated Abelian groups.

Course: MATH - 623 S Vector Analysis and Mechanics

After successfully completing this course, the students will be able to:

CO 1: Describe scalar and vector point functions. Perform differentiation and integration of vectors. Explain gradient divergence and curl operators, Green's and Stoke's theorems, Gauss' divergence theorem and Curvilinear co-ordinates.

CO 2: Discuss generalized co-ordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle of least action, reduction to the equivalent one body problem.

CO 3: Describe the equations of motion and first integral, equivalent one-dimensional problem and classification of orbits.

CO 4: Discuss the Viral theorem and the rigid body motion about an axis, moving axis.

Course: MATH - 624 S Complex Analysis - II

After successfully completing this course, the students will be able to:

CO 1: Recognize the singularities of complex valued functions.

CO 2: Classify Taylor series and Laurent series of complex valued functions.

CO 3: Determine bilinear transformation and conformal mapping.

CO 4: Grasp Weierstrass theorem, Mittagleffer's theorem.

CO 5: Solve the problems of Infinite product, Canonical produt and Natural boundary.

Course: MATH - 625 S Number Theory - II
After successfully completing this course, the students will be able to:

CO 1: Define Farey sequences, continued fractions, Euler summation formula, and Abel's identity.

CO 2: Describe the Pell's equation, approximation theorem of rationals, and Minkowski's theorem.

CO 3: Execute the problems on the partition functions, simple continued fractions, and averages of arithmetic functions.

CO 4: Use Minkowski's theorem in geometry of numbers and its applications, Ferrers graphs and Jacobi's formula.

S.Y. MSc (Mathematics) (SEM - III)
Course: MATH - 617 S Field Theory (Compulsory Course)

After successfully completing this course, the students will be able to:

CO 1: Apply the concept of a field extension to various mathematical problems including geometric constructions and perfect division of a circle into n parts.

CO 2: Test if a polynomial is irreducible finite field (Galois Fields).

CO 3: Grasp the concept of Galois Theory.

CO 4: Understand which types of equations can be solved by radicals.

Course: MATH - 618 S Topology (Compulsory Course)

After successfully completing this course, the students will/ will be able to:

CO 1: Gain knowledge about topological spaces, bases, diverse topologies on a set, e.g. subspace topology, metric topology, order topology, the product and quotient topology. Generalize concepts such as continuity, characterise homeomorphic spaces.

CO 2: Explain connected spaces, components and local connectedness in general topological spaces, compact spaces, limit point compactness, local compactness, nets and filters.

CO 3: Comprehend and apply the countability axioms - I, II. Understand Lindelof spaces, the separation axioms, regular, normal, completely regular and completely normal spaces.

CO 4: Explain Urysohn's Lemma, the Urysohn Metrization theorem, the Tietze extension theorem and the Tychonoff Theorem and discuss some important applications.

Course: MATH - 661 S Probability and Mathematical Statistics-I

After successfully completing this course, the students will be able to:

CO 1: Describe the nature of data and various methods of compilation such as measurement scales, attribute and variable, discrete and continuous variables. Discuss the notions of collection, compilation and tabulation of data.

CO 2: Represent the data by means of histogram, frequency polygon, frequency curve, ogives.

CO 3: Discuss the measures of central tendency such as mean, median, mode, geometric mean, harmonic mean and their properties.

CO 4: Describe the concept of range, quartile deviation, deciles and percentiles. Explain standard deviation, central and non-central moments, sample and population variance. Discuss the notions of skewness and kurtosis, Box and Whisker plot.

CO 5: Discuss the correlation & regression analysis: scatter diagram, Karl Pearson's and Spearman's rank correlation coefficient. Describe linear regression and its properties, the theory of attributes, independence and association.

CO 6: Discuss the intuitive concept of probability, combinatorial problems, conditional probability and independence, Baye's theorem and its applications.

CO 7: Explain random variables and distributions: discrete and continuous random variables. Describe the probability mass functions and Probability density functions. Explain the cumulative distribution function.

CO 8: Describe Expectation of single and two dimensional random variables, properties of random variables and the moment generating function and probability generating functions.

CO 9: Discuss and apply the notion of distributions, viz., Bernoulli, binomial distribution. Poisson, negative binomial, hypergeometric, uniform, normal distribution along with some applications.

CO 10: Explain the normal approximation to Binomial and Poisson distributions, Beta, Gamma, Chi-square and Bivariate normal distributions. Discuss the notion of sampling distribution of mean and variance (normal population). Detail about Chebyshev's inequality, weak law of large numbers and the central limit theorems. Apply the results studied to obtain the solutions of some real life problems.

Course: MATH - 678 S Linear Programming

After successfully completing this course, the students will be able to:

CO 1: Grasp concepts of linear programming along with examples, explain convex sets, hyperplane, open and closed half-spaces, feasible, basic feasible and optimal solutions, extreme point & graphical methods.

CO 2: Understand and apply simplex method, Charnes-M method, Two phase method, determine optimal solutions, unrestricted variables, duality theory, dual linear programming problems, fundamental properties of dual problems, complementary slackness, unbounded solution in primal. Discuss and apply the dual simplex algorithm, sensitivity analysis.

CO 3: Describe parametric programming, revised simplex method, transportation problems - balanced and unbalanced, U-V method, paradox in transportation problem. Discuss the assignment problems, integer programming problems: pure and mixed integer programming problems, 0-1 programming problem, Gomary's algorithm, branch & bound technique. Describe the travelling salesman problem.

S.Y.M.Sc (Mathematics) (SEM IV)

Course: MATH - 637 S Linear Algebra (Compulsory Course)

After successfully completing this course, the students will be able to:

CO 1: Define vector space, subspace, basis, linear independence, inner product space

CO 2: Determine eigenvalues, eigenvectors of a linear transformation

CO 3: Learn the method of diagonalization and triangularization of a matrix

CO 4: Reduce a matrix into Jordan and Rational Canonical form

CO 5: Gain the concept of dual space.

Course: MATH - 638 S Functional Analysis (Compulsory Course)
After successfully completing this course, the students will/ will be able to:

CO 1: Gain knowledge about Banach Spaces with examples of L^P([a,b]) and C([a,b]), the Hahn - Banach theorem, the open mapping theorem, the closed graph theorem, Baire Category theorem and the Banach - Steinhauns theorem along with some interesting consequences.

CO 2: Explain the boundedness and continuity of linear transformations, dual spaces, embedding in second dual and applications.

CO 3: Comprehend and explain the results in Hilbert spaces, the notion of orthonormal basis, Bessel's inequality, Riesz - Fischer theorem, Parseval's identity, bounded Linear functionals, projections and the Riesz Representation theorem.

CO 4: Describe the adjoint operators, self adjoint, normal, unitary and isometric operators.

Course: MATH - 681 S Probability and Mathematical Statistics-II
After successfully completing this course, the students will be able to:

CO 1 Discuss the general concept of point estimation, unbiasedness, consistency, efficiency and sufficiency. Explain factorization theorem, completeness, Rao-Blackwell theorem, Cramer-Rao inequality. Describe maximum likelihood method of estimation and method of moments.

CO 2 Explain interval estimation, confidence intervals for means, difference of means and variances.

CO 3 Explain the notion of hypothesis testing: significance test, null and alternative hypothesis, Type-I and Type- II errors. Uniformly most powerful tests, Likelihood Ratio tests, t, Chi-square and F-distributions. Discuss the tests of significance based on t, Chi-square and F.

CO 4: Discuss One way and Two way Analysis of Variance (ANOVA), non-parametric tests: sign test, Wilcoxon signed rank test, Mann-whitney test.

Course: MATH - 695 S Integral Transforms and their Applications
After successfully completing this course, the students will be able to:

CO 1: Recognize the different methods of finding Laplace transforms and Fourier transforms of different functions.

CO 2: Solve ordinary and partial, integro-differential equations using Laplace transforms.

CO 3: Familiarise with Fourier transforms and their relation with Laplace transforms

CO 4: Learn operational properties of Mellin transforms, Fourier series, Hankel transform and Laplace transforms.

CO 5: Apply the knowledge of L.T, F.T, and Finite Fourier transforms in finding the solutions of differential equations, initial value problems and boundary value problems.

Course: MATH - 698 S Non Linear Programming
After successfully completing this course, the students will be able to:

CO 1: Understand convex functions, concave functions, subgradients of convex functions, classify differentiable convex functions, maxima and minima of convex functions and concave functions. Describe the generalizations of convex functions and explain the associated properties.

CO 2: Describe unconstrained problems, necessary and sufficient optimality criteria of first and second order. Discuss first order necessary and sufficient Fritz John conditions and Kuhn-Tucker conditions for constrained programming problems with inequality and equality constraints, Kuhn Tucker conditions and linear programming problems.

CO 3: Discuss duality in nonlinear programming, weak duality theorem, Wolfe's duality theorem, Hanson-Huard strict converse duality theorem, Dorn's duality theorem, strict converse duality theorem, Dorn's Converse duality theorem, Unbounded dual theorem, theorem on no primal minimum, duality in Quadratic Programming.

CO 4: Learn and explain quadratic programming: Wolfe's method, Beale's method for quadratic programming, linear fractional programming, method due to Charnes and Cooper. Nonlinear fractional programming, Dinkelbach's approach.

CO 5: Explaina and apply game theory - two-person, zero-sum games with mixed strategies, graphical solution, solution via linear programming.

Programme Name: BCA (Mathematics*)

* Mathematics as one of the subjects in the undergraduate degree programme.

Programme Outcomes of BCA (Mathematics*)

After completing BCA (Mathematics*) programme, students will be able to:

PO 1: Think and analyse the mathematical formulations critically.

PO 2: Become familiar with the appropriate tools and methods to attempt basic and advanced problems in mathematics computationally.

PO 3: Pursue higher degree programmes in the allied areas.

PO 4: Develop problem solving strategies in real life problems.

Programme Specific Outcomes of BCA (Mathematics*)

PSO 1: Intimately connects the two disciplines mathematics and computational studies.

PSO 2: Promotes career opportunities in academia as well as industry.

PSO 3: Paves the way for pursuing higher degree programmes in the allied areas.

Programme Name: BCA (Mathematics*)

* Mathematics as one of the subjects in the BCA undergraduate degree programme.

F.Y.BCA (SEM - I)

Course: BCA-16-102 Fundamentals of Mathematical Statistics

After successfully completing this course, the students will be able to:

CO 1: Describe statistical techniques and data management, classification and organization

CO 2: Describe measures of central tendency, arithmetic mean, geometric mean, harmonic mean.

CO 3: Define median, partition value, mode and range.

CO 4: Discuss correlation analysis, types of correaltion, techniques of measuring correaltion, Karl pearson's correlation coefficient.

CO 5: Discuss regression analysis and various associated properties.

T.Y.BCA (SEM - V)

Course: BCA-16-502 Discrete Mathematical Structure

After successfully completing this course, the students will be able to:

CO 1: Understand and apply basics of set theory, relations and functions.

CO 2: Describe recurrence relations and recursive algorithms.

CO 3: Discuss basics concepts of Graph theory - multi-graphs, weighted graphs, paths and circuits, shortest paths, Eulerian paths and circuits. Travelling Salesman problem, planar graphs.

CO 4: Discuss the basics of Automata theory.

DEPARTMENT OF PHYSICS

PROGRAMME OFFERED: M.SC. (TYC) PHYSICS

PROGRAMME OBJECTIVES

- To impart quality education in Physical Sciences and honing their academic, professional and social skills, ethics as well as qualification.
- To provide opportunity for academic excellence and prepare students for the future academic/research endeavours.
- To provide academic counselling for higher studies.
- To enhance technical, analytical and communication skills of the students.

PROGRAMME OUTCOMES

After successfully completing the M.Sc. (Physics) programme, students will be able to:

PO 1. Develop necessary technical and analytical skills to pursue higher studies/research/professional career.

PO 2. Gain good knowledge and expertise in diverse areas of Physical science necessary to compete in national level tests like UGC-CSIR NET, JEST, GATE, etc., successfully.

PO 3. Acquire and further develop the communication skills with aid of ICT.

PO 4. Prepare for challenges arising in academic and professional life.

PO 5. Critically examine and tackle problems from a well-reasoned and logical perspective.

PO 6. Work and learn independently as well in team environment as per the demands of situation/problem/environment.

PROGRAMME SPECIFIC OUTCOMES

Successful completion of M.Sc. (Physics) programme, will help students to:

PSO 1. Equip themselves with theoretical and practical knowledge about the various disciplines of physics i.e. Nuclear/Particle Physics, Condensed Matter Physics, Electronics, Classical Mechanics, Statistical Mechanics, Quantum Mechanics and Mathematical Physics.

PSO 2. Simulate/conduct experiments followed by analysis and interpretation of data for arising from research problems.

PSO 3. Understand the role of Physics behind various modern technology.

PSO 4. Appreciate the role abstract thinking behind the comprehensions of physical senses.

PSO 5. Develop proficiency in scientific writing/presentation skills.

COURSE SPECIFIC OUTCOMES

MATHEMATICAL PHYSICS I (PHY 6001)

The successful completion of Mathematical Physics I will enable the students

CO 1. To learns the relation between the various physical phenomena and their mathematical idealization.

CO 2. To acquire the necessary mathematical competence based upon complex analysis, differential equations and special functions and interpret based mathematical models of physical behaviour.

CO 3. To apply various mathematical techniques for understanding theoretical treatment in different courses.

CLASSICAL MECHANICS (PHY 6002)

On satisfying the requirements of this course, students will have the knowledge and skills to:

CO 1. Learn the conceptual understanding to make predictions, and then approach the problem mathematically.

CO 2. Learn the important connections between theory and experiment.

CO 3. Learn the Lagrangian and Hamiltonian formalism, conservation theorems, rigid body motion, Hamilton's equations, Canonical Transformations.

QUANTUM MECHANICS I (PHY6003)

Upon successful completion, students will have the knowledge and skills to:

CO 1. Learn the mathematical tools needed to solve quantum mechanics problems and understands the concepts of basis and operators and bra and ket notation.

CO 2. Learn theory of angular momentum and spin matrices, orbital angular momentum and Clebsh Gordan Coefficient

CO 3. Learn both Schrodinger and Heisenberg formulations of time development and their applications.

CO 4. Learn Stationary state approximate methods, perturbation theory, variational method with applications and Fermi's golden rule and its application to radiative transition.

CLASSICAL ELECTRODYNAMICS I (PHY 6004)

The successful completion of Classical Electrodynamics I will enable the students:

CO 1. To learn Electrostatics, Magnetostatics, dielectrics and its applications.

CO 2. To solve boundary value problems using Green's theorem and method of images.

CO 3. Learn to unification of Electricity and magnetism.

CO 4. To learn propagation of electromagnetic waves in dielectrics, metals and plasma media, EM waves in bounded.

ELECTRONICS-I (PHY6005)

Upon successful completion, students will have the knowledge and skills to:

CO1. Learn electronics system with continuously variable signal

CO2. Learn function of basic components use in linear circuits

CO3. Learn basic construction, equivalent circuits and characteristics of basic devices.

MATHEMATICAL PHYSICS II (PHY 6011)

The successful completion of Mathematical Physics II will equip the M.Sc. student with:

CO 1. Knowledge of mathematical tools for developing and understanding theoretical treatment models.
CO 2. Understanding of Group theory.
CO 3. Numerical analysis to solve problems of computational physics.

QUANTUM MECHANICS II (PHY6012)

This course will enable the student to have basic knowledge about

CO 1. Theory of scattering and calculation of scattering cross section, optical theorem, Born approximation and its applications.

CO 2. Relativistic Quantum Mechanics using Dirac equation, Dirac matrices and the Klein Gordon equation etc.

CO 3. Second quantization of the Schrödinger wave field for bosons and fermions. Quantization of real and complex scalar field.

PARTICLE PHYSICS (PHY 6013)

CO 1. Recognise and name the six flavours of lepton and the six flavours of quark with their corresponding antiparticles.

CO 2. Learn balanced strong and weak interactions, understanding the role of gluons and W and Z bosons.

CO 3. To learn Invariance principles and conservation laws.

NUCLEAR PHYSICS I (PHY 6014)

The successful completion of Nuclear Physics I will enable the students to

CO 1. Learn and understanding of basic properties of nuclear structure like wave mechanical properties of nuclei, electric and magnetic moments, nuclear shapes.

CO 2. Classify and describe various types of nuclear reactions and associated conservation laws.

CO 3. Gain detailed understanding and insight into various modes of radioactive decay and its theoretical foundation and associated selection rules.

CO 4. Understand the nature of nuclear forces in detail with the help of deutron problem and further analysis using scattering experimental data.

CO 5. Describe properties, sources and understand detection of neutrons, and specifically the energy distribution of thermal neutrons.

CO 6. Enhance the knowledge of nuclear fission process.

ELECTRONICS-II (PHY6015)

Upon successful completion, students will have the knowledge and skills to:

CO 1. Learn symbols, truth tables, Boolean equations and working principles.

CO 2. Learn the flip- flop, shift register, counter, semiconductor memories for data processing circuits.

CO 3. Recognize and analyze the basic digital circuits and develop programming skill in assembly language

CLASSICAL ELECTRODYNAMICS II (PHY 7001)

The successful completion of Classical Electrodynamics II will enable the students:

CO 1. To learn special theory of relativity: Lorentz transformations and their covariant formulations.

CO 2. To understand motion of particle in constant and varying electric and magnetic fields including relativistic motions of charge particle and further its applications.

CO 3. To learn radiation from accelerated charges and their scattering by free and bound electrons.

STATISTICAL MECHANICS (PHYS7002)

The course provides an introduction to statistical Physics, mainly for system in thermal equilibrium. The successful completion of the course will lead to

CO 1. Understand quantum and classical statistical mechanics.

CO 2. Apply thermal and statistical principles in a wide range of applications.

CO 3. Learn a variety of mathematical techniques.

NUCLEAR PHYSICS II (PHYS7003)

At the end of the course, the students will be equipping students to

CO 1. Understand the concepts nuclear models like shell model, Collective Model etc. and the role of spin-orbit coupling in the shell structure of atomic nuclei, Harmonic anisotropic oscillator, Nilsson model, Rotational motion, Cranking shell model, Signature quantum number, Kinematics and dynamic moment of inertia.

CO 2. Define and analyze Nuclear reactions, Resonance and Optical model for nuclear reactions at low energies.

CO 3. Understand the behaviour of Nuclear Physics at extremes of stability, nuclear halos, proton rich nuclei, Radioactive ion beams, Production of super heavy nuclei.

CONDENSED MATTER PHYSICS-I (PHY7004)

The aim and objective of this course is to make the students familiar to the solids and their properties. After completion of this course students are expected to

CO 1. Learn the study of crystalline materials using diffraction, including concepts like reciprocal lattice and Brillouin zones and spatial symmetries of crystalline solids.

CO 2. Possess understanding and knowledge of Lattice vibrations (phonons), dispersion relations and thermal properties of solids.

CO 3. Analyze electrical properties in the free-electron and band theory of solids and transport properties of solids using the Boltzmann transport theory.

CO 4. Gain knowledge of fundamentals of dielectric and ferroelectric properties of materials.

PARTICLE PHYSICS II (PHY7051)

This course, Particle physics will provide the students an overview of current concepts and theories in the field. After studying the course students will be able to:

CO 1. Learn about Symmetries and symmetry groups.

CO 2. Learn quarks model and its applications.

CO 3. Learn Unified theory.

CONDENSED MATTER PHYSICS-II (PHY7052)

The aim and objective of this course is to make the students familiar to the advanced techniques and properties of solids. After completion of this course students are expected to

CO 1. Learn and analyze the optical properties of isotropic solids, propagation of light in conducting media, piezoelectricity and ferroelectricity and magnetic properties of solids.

CO 2. Understand the concept of superconductivity, BCS theory of conventional superconductors, High T_c superconductors.

CO 3. Define and identify crystal defects and dislocations.

CO 4. Gain the knowledge of Liquid crystals.

EXPERIMENTAL TECHNIQUES IN NUCLEAR AND PARTICLE PHYSICS (PHYS7053)

The successful completion of course on Experimental Techniques in Nuclear and Particle Physics will enable the students to

CO 1. Learn and apply theoretical aspects of different equipment and methods used in the fields of Nuclear and Particle Physics.

CO 2. Have functional knowledge for interpretation, application of error analysis on statistical experimental data

CO 3. Have understanding of the working of basic detector and electronic systems used in nuclear and particle physics experiments.

CO 4. Gain insight to High-Energy Physics experiments and associated instrumentation.

ANALYTICAL TECHNIQUES FOR MATERIALS (PHYS 7057)

The successful completion of course on Analytical techniques for materials will enable the students to

CO 1. Learn diffraction, including interpretation of basic X-ray data and able to index the peaks and infer the structure.

CO 2. Learn relation between processing, structure, and physical properties.

CO 3. Learn basics of molecular physics, lasers and classification of transducers and related physics.

CO 4. Learn the various techniques for sample preparation and characterization.

PHYSICS LAB-1 (PHY6051) AND LAB-2 (PHY 7071)

The successful completion of Physics Laboratory I and Physics Laboratory II the students of M.Sc. will:

CO 1. Have the knowledge of experimental techniques in general Physics, electronics, nuclear Physics and condensed matter Physics.

CO 2. Be able to co-relate the theoretical concepts with the experimental ones.

CO 3. Will have the skill to execute experiment and deduce outcomes and conclude results.

COMPUTATIONAL PHYSICS LAB I (PHYSICS 7022) AND LAB II (PHYSICS 7073)

On completion of this course, students should be able to:

CO 1. Learn the features, syntax and semantics of the C++ programming language.

CO 2. Learn data Types, Mathematical, Relational, Logical and Bitwise Operators, Expressions and Statements.

CO 3. Demonstrate basic knowledge of numerical methods, random numbers generators, Numerical solution of differential equations.

B.Sc. (Non-Medical) and B.Sc. (Computer Science Programmes)

The Department of Physics offer Physics as an elective course in the form of three papers and practicals in each semester of B.Sc (Non-Medical) and B.Sc. (Computer science) Programmes. The Course specific outcomes for these are detailed below

B.Sc. Physics Semester I

Paper A: MECHANICS-I

After successfully completing the course students will be able to

CO1: Learn the basics of Cartesian and spherical polar co-ordinate systems

CO2: Describe centre of mass and kinematics of a system of particles.

CO3: Gain in depth information about various forces in nature, space-time symmetries

CO4: Understand potentials and fields, central forces and Kepler's laws

Paper B: VIBRATIONS, WAVES & E.M. THEORY-I

After successfully completing the course students will be able to

CO1: Understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations

CO2: Learn about forced mechanical and electrical oscillators.

CO3: Gain knowledge about coupled oscillators, normal modes of vibration, Inductance coupling of electrical oscillators.

Paper C: ELECTRICITY AND MAGNETISM-I

After successfully completing the course students will be able to

CO1: Learn basic ideas of Vector Calculus

CO2: Understand divergence, gradient and curl and their physical interpretation.

CO3: Describe applications of divergence theorem, Green's theorem, Stokes' theorem.

CO4: Gain knowledge about electrostatics and laws governing the charge distribution

CO5: Study in depth about Polarization, bound charges and boundary conditions.

B.Sc. Physics Semester II

Paper A: MECHANICS – II

After successfully completing the course students will be able to

CO1: Understand the motion of objects in different frame of references.

CO2: Describe fictitious forces in a rotating frame of reference.

CO3: Learn about stationery universal frame of reference and ether

CO4: Develop understanding of special theory of relativity and its applications

Paper B: VIBRATIONS, WAVES & E.M. THEORY-II

After successfully completing the course students will be able to

CO1: Learn about wave equation and its solution

CO2: Describe transverse waves on a string, characteristic impedance

CO3: Understand physical interpretation of Maxwell's equations

CO4: Study in depth about EM waves in a conducting medium and skin depth

Paper-C: ELECTRICITY AND MAGNETISM-II

After successfully completing the course students will be able to

CO1: Demonstrate magnetic field for steady currents using Biot-Savart and Ampere's laws

CO2: Learn about behaviour of various substances in magnetic field

CO3: Understand vector potential, Faraday's Law of EM induction and Displacement current

CO4: Demonstrate Self inductance and Mutual inductance in solenoid.

Physics Practical (Semester I & II)

From successfully performing the experiments, students will be able to

CO1: Preform precise measurements of time, length, thickness and curvature

CO2: Understand concept of moment of inertia

CO3: Learn about elastic constants and related quantities

CO4: Determine low resistance using Carey Fosters Bridge.

CO5: Demonstrate variation of induced e.m.f. as function of the velocity of the magnet

CO6: Study impedance of LCR circuit

CO7: Demonstrate use of De-Sauty's bridge and Anderson Bridge

B.Sc. Physics 3rd Semester

PAPER A: Statistical Physics and Thermodynamics - 1

After the successful completion, students will be able to:

CO1: Understand the basic ideas and scope of Statistical Physics.

CO2: Have insight of the basic statistical methods and concepts like probability, random variables, expected value, variance and common probability distributions.

CO3: Understand the relation between microscopic and macroscopic description through statistical mechanics, effect of constraints on the system.

CO4: Learn the equilibrium state of dynamic system with distribution of n-particles in two and k compartments of unequal sizes.

CO5: Understand the phase space and its division into elementary cells.

CO6: Explain the basic approach in three statistics: Maxwell-Boltzman statistics, B.E. statistics, F.D. statistics and Comparison of M.B., B.E. and F.D.

PAPER: B OPTICS AND LASER-1

After the successful completion, students will be able to:

CO1: Recognize phenomenon based on light and related theories.

CO2: Get skills to identify and apply formulas of optics and wave physics

CO3: Understand the event like reflection, refraction, interference, diffraction etc. and their applications.

CO4: Understand the resolving power of different optical instruments like Young's double slit experiment. Lloyd's mirror and Fresnel's biprism,

PAPER C: QUANTUM MECHANICS -1

After the successful completion, students will be able to:

CO1: Understand the origins of quantum mechanics, fundamental postulates of quantum mechanics. Eigenvalues and eigenfunctions and operator formalism

CO2: Learn Plancks's formula of Black body radiation and energy quantization,

CO3: Discerning Wave-particle duality – Photoelectric effect, X-ray diffraction, Compton effect, Pair production, Photon and gravity.

CO4: Have the knowledge of de Brogile waves, wave packet, Phase velocity and Group velocity, Electron microscope, Particle in a box, Particle diffraction, Davisson-Germer experiment, Interferometry with particles.

CO5: Understand the Uncertainty principle with illustrations, Principle of complementarity.

CO6: Spot, identify and relate the Eigen value problems for energy, momentum, angular momentum and central potentials

CO7: Develop the idea of spin and quantum statistical mechanics

CO8: Understand the Problems in One and Three Dimensions using time dependent and time independent Schrödinger wave equations.

B.Sc. Physics 4th Semester

PAPER A: Statistical Physics and Thermodynamics – II

After the successful completion, students will be able to:

CO1: Statistical definition of entropy, change of entropy of a system, additive nature of entropy, law of increase of entropy, reversible and irreversible processes with examples.

CO2: Learn to evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.

CO3: Understand the efficiency of Carnot's engine and the significance of first law and second of thermodynamics and implications of the second law of thermodynamics and limitations placed by the second law on the performance of thermodynamic systems.

CO4: Grasp the interrelationship between thermodynamic functions and ability to use such relationships to solve practical problems.

CO5: Understand the derivation of Maxwell's thermo-dynamical relations and applications.

CO6: Get the idea of the thermo-dynamical treatment of Joule-Thomson effect. Use of Joule-Thomson effect for liquification of helium, and production of very low temperature by adiabatic demagnetization.

PAPER-B: OPTICS AND LASERS-II

After the successful completion, students will be able to:

CO1: Understand the Laser Fundamentals and Interaction of light with matter.

CO2: Know the Kinetics of optical absorption (qualitative account only) Qualitative account of Collisional broadening, Doppler broadening & Natural broadening,

CO3: Learn the Mechanism of Luminescence, Lasing action, Components of Laser, Elementary theory of optical cavity,

CO4: Understand the Laser Systems: Types of lasers, working and their working.

CO5: Get insight of the Fiber Optics: Photonics, Optical fibre, Construction, and their application.

CO6: Understand the Optical fibre based communication system, Medical applications.

PAPER-C: QUANTUM PHYSICS-II

After the successful completion, students will be able to:

CO1: Know the Radiative transitions, selection rules and life times, Spectrum of hydrogen atom, Degeneracy of H-atom energy levels, fine structure,

CO2: Understand the Electron angular momentum, Larmor's frequency, electron spin angular momentum, Exclusive principle, Stern Gerlach experiment, spin-orbit coupling, electron magnetic moment, total angular momentum,

CO5: Learn the Hyperfine structure, examples of one electron systems, Anomalous Zeeman effect, Lande-g factor Paschen-Back Effect, Stark Effect

CO6: Understand the Symmetric and Antisymmetric wave functions, exclusion principle, Many electron atoms

CO7: Recognize the Electronic configurations, Hund's rule, Spin-Orbit coupling, L-S coupling, J-J couplings, term symbols. Atomic spectra of H, Na, He and Hg, selection rules. X-ray spectra, nomenclature,

CO8: Understand the Complex molecules, molecular spectra, selection rules, symmetric structures, rotational vibrational levels and spectra of diatomic molecules, vibration-rotation spectra, electronic spectra of molecules,

CO9: Identify the Franck Condon principle, fluorescence and phosphorescence, Raman Effect, Magnetic resonance experiments

PHYSICS LAB (3^{rd} and 4^{th} Semesters)

The aim of the Laboratory is to develop the scientific and technical temper in the students and as such it may consist of development of a laboratory experiment, fabrication of a device or electronic circuit etc.

CO1: Identify optical components and systems.

CO2: Understand, and choose different models for light.

CO3: Ability to calculate light level and ray paths in optical systems.

CO4: Knowledge of the operating principle of some important types of optical instruments.

B.Sc. Physics 5th Semester

PAPER A: CONDENSED MATTER PHYSICS - I

After the successful completion, students will be able to:

CO 1. Gain insights of basics of crystalline structures of solids

CO 2. Understand the concept of reciprocal lattice for the theoretical study of crystalline solids

CO 3. Understand the band theory of electronic structure of solids

CO 4. Distinguish between metals, semiconductors and insulators

CO 5. Enhance the knowledge of free electron theory of metals

PAPER B: ELECTRONICS AND SOLID STATE DEVICES - I

After the successful completion, students will be able to:

CO 1. Learn the concept of current and voltage sources and application of Thevenin's and Norton's Theorems.

CO 2. Understand and explain the construction and principle/working of CRO and its applications.

CO 3. Enhance the knowledge of semiconductors and associated devices like pn-junction and Zener diode and interpretation with the help of energy band diagrams.

CO 4. Interpret and analyze various kinds diode circuits like clipper, rectifiers.

CO 5. Understand the structure and working of Bipolar Junction Transistor, its characteristics.

CO 6. Analyze the role of BJTs in CB, CE and CC configuration amplifiers.

CO 7. Gain insight about h-parameters through analysis of CE amplifiers.

PAPER C: NUCLEAR & PARTICLE PHYSICS - I

After the successful completion, students will be able to:

CO 1. Understand and gain insight into the quantitative and qualitative properties of atomic nuclei.

CO 2. Describe the nature of nuclear forces using meson theory.

CO 3. Learn about the features and applications of liquid drop model and shell model.

CO 4. Acquire detailed knowledge about radioactivity and differentiate between its various modes.

CO 5. Classify nuclear reactions and associated theoretical concepts.

B.Sc. Physics 6th Semester

PAPER A: CONDENSED MATTER PHYSICS - II

After the successful completion, students will be able to:

CO 1. Gain insights of basics of lattice dynamics, phonns ans specific heat of solids

CO 2. Understand the microscopic mechanism of magnetic phenomena in solids

CO 3. Gain the knowledge of Iiquid crystals and their applications

CO 4. Enhance the knowledge of phenomenon of superconductivity

CO 5. Acquire the knowledge of fast emerging field of nanomaterils

PAPER B: ELECTRONICS AND SOLID STATE DEVICES - II

After the successful completion, students will be able to:

CO 1. Learn the structure and working of JFET and MOSFET in detail alongwith their characteristics.

CO 2. Describe in detail about various types of oscillators and feedback in amplifiers.

CO 3. Understand the characteristics and application of operational amplifiers.

CO 4. Convert binary and decimal numbers and apply Boolean algebra for simplification of logic circuits.

CO 5. Draw and explain various logic circuits.

CO 6. Gain insight into the analog and digital communication systems, modulation-demodulation.

PAPER C: NUCLEAR & PARTICLE PHYSICS - II

After successful completion, students will be able to:

CO 1. Understand the interactions of different types of nuclear radiation with matter

CO 2. Analyze the energy loss mechanism due to various factors.

CO 3. Gain knowledge into principle, construction and working of various radiation detectors (Gas-filled detectors, Scintillation detectors and Semiconductor Detectors).

CO 4. Classify elementary particles and detail their respective properties, detail the role of symmetry and conservation principles and describe quark model

CO 5. Know the origin and composition of cosmic rays.

CO 6. Gain insight into the working of various particle accelerators and Accelerator facilities available in India.

PHYSICS PRACTICALS (5^{th} and 6^{th} Semesters)

CO 1. To develop the scientific and technical temper in the students.

CO 2. To train students for laboratory experiment, fabrication of a device or electronic circuit etc.

CO 3. To establish bridge between theoretical and experimental concepts in condensed matter physics, nuclear physics and electronics

CO 4. To develop the ability to acquire, analyze and interpret experimental data followed by its presentation.

Learning Outcomes from the Subject Physical Education

Modern life, as characterized by sedentariness, automation and computerization, has created a new class of human beings who just sit for hours each day. The 21st century is an age of space and technological gigantism, charged by speed, noise and other tension producing factors. The stress created by the demands of our social, and economical systems, and our devotion to intellectualism is tremendous. Urban life style has caused many tensions and it will grow worst for mankind.

Physical Education has a special significance, unique role and has made unlimited contribution in the modern age as it caters to the biological, sociological, and psychological necessities of the man. Swami Vivekananda has stressed that "What India need today is not the Bhagwat Gita but the football ground." Physical Education is of great value for the man not only for his present but also for his future. Emphasizing the need and importance of physical education, Rousseau said, "It is the sound constitution of the body that makes the operation of mind easy and certain."

B.A I

B.A I (Semester- I)

- The objective of this paper is to provide basic knowledge about the concept and historical development of Physical Education in India.
- It provides information about the origin of various sports events and competitions such as Ancient and Modern Olympic Games, Asian Games and Commonwealth Games etc.
- This would help the students to understand the subject in depth and he/she may opt this subject as professional career in future.
- It also elaborate the functions of governing bodies such as Sports Authority of India (SAI), Indian Olympic Association and International Olympic Committee.
- Since, Physical education has become an integral part of school curriculum all over the world, this would help the students to opt this subject as a professional career. Hence, the basic knowledge about the concept and its development as a professional career is important.

B.A I (Semester- II)

This paper explain the anatomy and physiology of human body. Since, the subject is related to physical activity and bodily movements, the students must possess the knowledge about the human structure and it's functioning in relation to physical activity and exercise.

Learning outcome:

It provides fundamental knowledge about the structure of Cell, Skeletal System and Muscular System along with the short term and long term effect of exercise on various systems.

- The paper aim to provide the knowledge about the concept of warming up and cooling down and its significance in the field of sports. The student would understand the importance of physical

fitness in their lives. This may encourage them to take part in regular physical activity program for the fitness and better lifestyle.

- The knowledge about the concept of Health and Health Education and its importance in today's scenario has great role to play. Hence, the idea is to provide this knowledge with the help of content given in the syllabus. This would help the students to inculcate healthy living (health care, hygiene and wellness).
- First aid is very important in our daily lives and specifically in the field of games and sports. So, it is very essential that students must have some knowledge about first aid. Keeping in view the necessity of the content it has been given to promote safer practice among the students.
- The content includes biological basis of Physical Education which enables the students to have basic knowledge related to growth and development and the factors which may affect the process of growth and development. It also help the students to know about the various stages of growth and development. Make them understand the physical, physiological, intellectual, social and emotional development taking place during these stages of growth and development.
- Hence, the content of the paper is designed to make the students understand various concepts related to physical and bodily movement and their effect on various systems along with the effect of their exercise on the process of growth and development of a person.

B.A II

Learning Outcome

B.A II (Semester- III)

The aim of content of semester III is to provide various aspects of psychology and sports psychology, which helps the sports persons to improve their performance.

- Enables the students to have knowledge of the psychological factors affecting performance.
- Thrown light on the meaning and laws of learning.
- Highlights the meaning of learning curve and its importance in Physical Education.
- Guides the students to deal with psychological problems and what role does Physical Education plays in showing their problems.
- An understanding of motivation and methods to motivate sports persons.
- Knowledge of transfer of training.
- Make students understand about the personality and its traits and role of politics, economy and media in promoting sports.
- Makes students familiar about the history, rules, regulations, basic fundamental and major tournaments of Softball.

B.A II (Semester- IV)

Learning Outcome:

The main aim of the content of semester IV is to enable the students to be familiar with the physiological systems of the body, blood and its composition, communicable diseases, yoga, basic of tennis and sports injuries.

- The subject content deals with Respiratory System so that the sports persons have the knowledge of level of training to be done for improvement in sports.
- Knowledge of Digestive System and its organs.
- To throw light on Circulatory System of the body, Heart and its structure so that the sports persons are aware of the circulation of the blood in the body and to what extent the heart can be overloaded while performing vigorous activities.
- To make students understand about the functions and composition of blood, different blood groups and the meaning of blood clotting.
- The content deals with communication diseases like HIV/AIDS, Hepatitis and Tetanus and their mode of transmission so that they can prevent themselves from these diseases.
- Yoga plays a great role in improving the health status of people. It is widely spread in all the countries. The content aim is to provide knowledge to the students about the importance of yoga and practice of various cultural and meditative poses.
- Students also have the understanding of history, rules and regulation, basic fundamentals of Tennis.
- The content further acquaint the students with the knowledge of common sports injuries and their causes and preventions as injuries are part of sports and physical activities.
- Knowledge of basic treatment of these injuries helps the players to control the injury at the initial stage itself before it gets worse.
- The content further elaborates the types and causes of Disability and Rehabilitation to regain the former fitness after an injury.

B.A III

B.A III (Semester- V)

The objective of the syllabus is to provide broad understanding of play, recreational, competitions, camps, posture and postural deformities, massage and its importance and basic understanding of cricket.

Learning outcome:

The students of physical education semester V will have the conceptual knowledge of the following:

- Sports person and general public will be benefited by having the knowledge of importance and types of massage.
- Stress, hypertension etc. can be removed by having the knowledge of recreational activities and play.
- Students will have the understanding of organizing camps and competitions.
- The content will also help the professional Physical Education students to organize athletic meet in their respective schools and colleges.
- Postural deformities like kyphosis, lordosis, flat foot, knock knees are very common among students these days due to sedentary life style. The content helps the students and society for healthy living.

- Students will also have the knowledge of effects of physical activities and their effects on aging and the body composition. Lack of physical activities have made people obese, resulting in various diseases like blood pressure, heart attack etc. Society can be made aware about the importance of physical activities.

B.A III (Semester- VI)

The content of semester VI will highlight various physiological systems of the body like nervous system, excretory system, and endocrine system. The content of this semester also aims to provide knowledge about sports training and general physiological concepts like vital capacity, oxygen debt, fatigue muscular contraction, meaning of blood pressure and hypertension in order to improve performance and become elite players.

Learning outcome:

The students of physical education semester VI will have the conceptual knowledge of the following:

- Learn the functioning of nervous system, which is in our body's decision and communication center.
- Will have the understanding of excretory and endocrine systems.
- Sports persons can enhance their performance and can become elite athletes through the knowledge of chapter sports training.
- In every day to day life the common problems like blood pressure, obesity, heart problems and hypertension are faced by a large number of the people. Student will have the knowledge of measuring blood pressure, vital capacity, causes and preventions of obesity, hypertension, benefits of exercise in getting rid of these common diseases and making life smooth and healthy.
- Will have the understanding of career aspects and scope for physical education after completing their graduation with physical education as one of the elective subject.

Department of Political Science

Bachelor Degree Programme

The Department of Political Science, Sri Guru Gobind Singh College was established in the year 1966, with a determined aim to bring forth the distinct political theories and concepts and make the students aware of the current political trends at both national and international level. The syllabus of the courses has been framed, in accordance with the objective to make the students aware about the dynamic character to the Discipline. Changes in political environment happen radically leaving everybody off the guard, As Vladimir Lenin says," There are decades where nothing happens and there are weeks where decades happen".

The esteemed teachers of the Department of Political Science have explored rigorously the current syllabus and tried to chalk out some specific outcomes of B.A. three year, six semesters Programme of their own. Such expected Outcomes may be listed as follows –

Program outcomes

After successfully completing B.A. Political Science Programme students will have

PO1: Knowledge about the recent political happenings: The course aims to make the students have an enriched knowledge system about the important political theories, concepts and issues. In addition to that course provides the students with understanding of dynamic aspects of discipline.

PO2: Awareness about contemporary trends in politics: More importantly, the programme is expected to generate an in depth awareness among students regarding the events and trends taking place in the contemporary times. The outcome is expected to not only create awareness but also generate the ability among students to understand and make sense of the syllabus related theories in consonance with the recent political trends and events.

Program specific outcomes

The current syllabus is well chosen of the topics from the whole corpus of Political Science to represent distinct theories and issues from different dimensions. They are not only meant to make the students familiar with the dominant trends of the contemporary times, but also to open out new knowledge systems. The student, with the current syllabus is expected to be able to corroborate recent events with the important theories and concepts of political science along with obtaining an understanding of the changing nature of politics in the changing times.

Course Outcome

Semester 1; POLITICAL THEORY-I

CO1. The paper offers the first year undergraduate students with the basic aspects, concepts and themes in the discipline of Political Science. The course would bring conceptual clarity to the students while putting light on the very basic ideas of state, Political system and sovereignty.

Semester II; POLITICAL THEORY-II

CO1. The expected output of this paper is to deepen and expand the theoretical knowledge of the subject. This course provides the students with better understanding of the concepts that have shaped our politics, including freedom, equality, liberty, democracy and justice. Paper helps the students to determine the political values and attitudes of the people and their transferability through the concepts like Political culture and political socialization respectively. This course makes students explore, what a better political world would look like and how we can create it.

Semester III; INDIAN GOVERNMENT AND POLITICS

CO1. The purpose of this paper is to deepen the knowledge and understanding of one of the most powerful forces operating on people, communities and corporations today, namely Government and politics in India. This paper reflects on the supreme law of the land that is Constitution of India while exaggerating the basic features of the constitution, namely fundamental Rights and Duties along with Directive principles of state policy, Legislature, Executive and judiciary at center and state levels. This paper enriches the understanding of students about the working of governmental institutes in India.

Semester IV; INDIAN POLITICS

CO1. The expected outcome of this paper is to enrich the student's understanding of the working of the Indian political system with reference to political parties, the party system, elections and voting behavior. One gets to understand the wider perspective about emerging trends and debates in contemporary India as we have witnessed the corona virus as a game changer in political atmosphere. It also covers the recent developments in Indian Foreign Policy in the emerging/changing world order.

Semester V; COMPARATIVE POLITICAL SYSTEMS (UK AND USA)

CO1. The study of comparative political system is a great way to gain a deeper understanding of distinct political systems. The expected outcome of this paper is to serve as an introduction to the field of comparative politics. It provides a broad overview of the field of comparative government and politics and examines some key approaches. It's an intriguing and important subject which places great emphasis on analyzing the origins and working of two absolutely distinct and different political systems, the UK (the mother of all constitutions) and the USA (the first written constitution of the world). The student will not only become familiar with the working of these two political systems but also understand how the concepts of comparative politics can be used to understand real world politics.

Semester VI; INTERNATIONAL POLITICS: THEORY AND PRACTICE

CO1. This paper provides awareness to the students about the Idealist and Realist views of the world. It also highlights the key issues namely, Balance of Power and Collective Security while bringing emerging trends in international politics into the light. Most importantly this course helps the students to gain understanding about the locus of power at the global level by making them recognize Unipolar, Bipolar and Multi-polar world.

Department of Public Administration

Programme Outcome

Bachelor of Arts degree requires full time study comprising of two semesters per year for three consecutive years. This course introduces a wide range of concepts to the students through different subjects, which helps them to inculcate reasoning ability to withstand different challenges in the contemporary era. It also emphasizes on analytical and critical thinking in analyzing the problems with their active involvement and cooperation. This course aims at preparing the students with adequate knowledge, skills and proficiencies to connect with multifarious domains, which are inter-disciplinary such as cultural, social, political, geographical, environmental, administrative and economic. It dwells upon deep understanding of ethical behaviour and lifelong learning habits. The discipline of Public Administration started as a systematic and scientific study of functions of Government in multiple domains and at different levels. It is a field of enquiry with a diverse scope. It is a combination of both theory and practice, which studies and analyzes the machinery and procedure of Government.

Programme Specific Outcomes:

(SEM 1) Administrative Theory: The course is intended to familiarize the students to the foundational concepts in the discipline of Public Administration, its Evolution, Development of Principles of Administration, its Nature, Scope and Significance. Students are acquainted with better understanding regarding the progression and changing dynamics of Public Administration as a field of study as well as its practical applicability in the Public Sector, Corporate Sector at National level and Globally.

SEM II) Indian Administration: Students have high-level ability to combine theory and practice in a meaningful way to address the contemporary issues in the Indian Administration. Students will be exposed to the working of President of India, Prime Minister, Chief Minister, Governor, Lok Sabha, Rajya Sabha, Cabinet Secretary and Indian Judiciary.

III) Personnel Administration: The course is intended to make the students well acquainted with the Recruitment, Selection, Training and Promotion process in Public Services. They are also made aware about working of Bureaucratic System, the problems of prevailing Corruption in the System and the importance of placing the right person on the right job. Emphasis is also laid on recognizing MEN as the most important resource of the Nation.

IV) Financial Administration: Finance is the lifeblood of any Business Organization or of Administrative Systems. This particular course helps the students to take sound financial decisions, which will effect the entire business operations of the concern. They will also learn the entire financial set up of the Administration in our country by understanding the functioning of Finance Ministry, Finance Commission, Preparation, Presentation Execution and Auditing of the Budget of Government of India and by accumulating the knowledge about different types of prevailing taxation policies. They will be able to do good financial planning, proper use of funds, good financial decisions, improve profitability and promote savings.

V) Local Government: The importance of this paper is that Local Government is the nursery of Democracy. If Democracy has to function properly then it is necessary to ensure participation of all the citizens in the decision making process. By studying this paper, the students get to know about the functioning of the Government at the lowest rung. Local Governments create future leaders as well. They are made aware about the functioning of Rural Local Bodies, Urban Local Bodies and District Administration. Local Governance needs to happen when people live in a community, have sufficient close interaction and to solve their problems; they must work together as a group in order to achieve the desired results. Because of this process of Local Governance, there is close relationship between Civil Society and Government, thereby determining the Government's action.

VI) Development Administration: We as the Citizens of India are part of all the developmental activities going on in our developing nation. To achieve the developmental goals, it is essential that future generation is

made aware about the proper Assessment of the Resources, proper Plan Formulation, Evaluation and Implementation, Adequate Involvement of People, emphasis on Technological Change and Self Reliance. In today's context, Sustainable Development also has to be kept in mind as we are facing extreme scarcity of natural resources, climate change and many self created problems like pollution and use of plastic etc. Development is the end result of Public Administration. Development Administration is an intellectual enterprise with which defined goals of development like Welfare of People, Increase in Per Capita Income, Empowerment of Marginalized, Implementation of Plans, Strategies to ensure Sustainable Development and Eradication of Poverty etc. can be attained. By gaining all this knowledge, students will become part and parcel of development as future decision makers.

Course Specific Outcomes:

- **Thorough Knowledge and Understanding of Fundamentals of Administrative aspects of Governance:** Public Administration as a body of knowledge provides quintessential understanding of the emerging trends and challenges faced by Governing Authorities amongst developed and developing countries in the contemporary scenario. The course also provides expertise in numerous ways that contributes towards the development of new practices and procedures in the domain of governance.
- **Promotes Critical Thinking and enhances Decision-making:** The course enhances the ability to ascertain the critical role of Administrators and Managers by enabling the students to have a deep-rooted knowledge of SMART (Sincere, Moral, Accountable and Actively Involved, Responsible and Transparent) Citizens. The readings, classroom activities, discussions and special lectures also inculcate effective communication; encourage critical thinking and reasoning in the students.
- **Research and Development:** The deep understanding of different areas within Public Administration stimulates research and experimentation by the students of the subject on diverse social aspects. It also promotes the application of knowledge, which leads to understanding the core aspects of public as well as private administrative systems, present simultaneously in our country.
- **Career Opportunities in Multifarious spheres:** It provides various opportunities and open up the arena of different career options for the students of the subject. They can enter into sphere of Civil Services, Corporate Sector, Field of Education, Health, Finance, Politics and many more. It focuses on enabling the students to polish their knowledge about the linkages amongst the social, political, cultural, environmental and administrative realms, which is substantial to pursue their career opportunities.
- **Preparing future Leaders:** The students of this discipline are prepared in advance to confront the problems, which they are going to face from community, corporate and public sectors, in case they opt for leadership as their career opportunity. All the qualities to become a good Leader are learned by the students. They also learn the skills to apply inter-disciplinary approaches to meet the challenges in the political environment.
- **Better understanding of Governance:** The subject will create a broad understating of Public Affairs, Policy Development, Policy Analysis, Economic Analysis, Management Skills, Organization Theory and application of all these to the Public Services. It will lead to application of Critical Thinking and to conduct a purposeful enquiry exploring the problems faced by the Nation. The Public Administrators will work with and for others in ways that translate community needs into policy solutions. The Public service actions will promote a Just and Humane world. The Administrators will have effective communication for different audiences and purposes.
- **Proper management of Financial Resources:** The Public Administrators are very well aware of management of scarce financial resources in Developing Economies like ours. They will evaluate the financial conditions; manage the Budget and Financial Monitoring systems to support decision-making and administrative priorities. They will organize the processes to raise revenues and articulate the fundamentals of Public Finance and Taxation policies.
- **Contribution towards welfare state:** The subject provides numerous opportunities to the students to learn about various techniques through which they can contribute in making up of a welfare state. Students get to know about various services that are provided to the citizens of the country.

- **As an Instrument for the Sustainable Development:** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs is called sustainable development. That means economic development without harming the environment. Public Administrators play a significant role in the protection of environment. All the environmental issues are solved through public administration.
- **Preparing future Supervisors:** The students of this discipline are prepared in advance to confront various problems, which they are going to face in their professional organization. All the qualities to become a good supervisor are learned by the students. They also acquire monitoring techniques and approaches which ultimately help them to achieve the goals of the organization.

- **As an Instrument for Community Development:** Different races and religions live in every country. Therefore, a common policy for all does not apply effectively. Public administrators gathers neutral information about each community in the society and based on that information they makes policies and for particular community. So public administrators play a leading role in community development.

Program Outcome of Punjabi Department

Introduction – ਪੰਜਾਬੀ ਵਿਭਾਗ ਵਿਚ ਪੰਜਾਬੀ ਦਾ ਅਧਿਆਪਨ ਦੋ ਪੱਧਰਾਂ ਤੇ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ :

1 ਅੰਡਰ ਗਰੈਜੂਏਟ ਪੱਧਰ

2 ਪੋਸਟ ਗਰੈਜੂਏਟ ਪੱਧਰ

1 ਅੰਡਰ ਗਰੈਜੂਏਟ ਪੱਧਰ ਤੇ ਪੰਜਾਬੀ ਦੇ ਦੋ ਵੱਖ – ਵੱਖ ਕੋਰਸ ਪੜ੍ਹਾਏ ਜਾਂਦੇ ਹਨ :

- **ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ**
- **ਪੰਜਾਬੀ ਚੋਣਵਾਂ ਵਿਸ਼ਾ**

ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ

ਬੀ.ਏ. ਦੇ ਛੇ ਸਮੈਸਟਰਾਂ ਵਿਚ ਅਤੇ ਬੀ.ਐਸ.ਸੀ. , ਬੀ.ਸੀ.ਏ. , ਬੀ. ਕਾਮ ਵਿਚ ਦੋ ਸਮੈਸਟਰਾਂ ਵਿਚ ਪੜ੍ਹਾਈ ਜਾਂਦੀ ਹੈ , ਇਸ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਬੋਲਣ, ਲਿਖਣ , ਪੜ੍ਹਨ ਅਤੇ ਸੁਣਨ ਵਿਚ ਪਰਪੱਕ ਕੀਤਾ ਜਾਂਦਾ ਹੈ ਅਤੇ ਵਿਦਿਆਰਥੀਆਂ ਦੇ ਨੈਤਿਕ ਪੱਧਰ ਵਿਚ ਵਾਧਾ ਕਰਨ ਦਾ ਯਤਨ ਕੀਤਾ ਜਾਂਦਾ ਹੈ।

ਪੰਜਾਬੀ ਚੋਣਵਾਂ ਵਿਸ਼ਾ

ਇਸ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਆਕਰਣਿਕ ਪੱਖਾਂ ਅਤੇ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦੇ ਵਿਭਿੰਨ ਰੂਪਾਂ (ਕਵਿਤਾ , ਕਹਾਣੀ, ਨਾਵਲ , ਨਾਟਕ ਅਤੇ ਇਕਾਂਗੀਆਂ ਆਦਿ) ਦਾ ਦੀਰਘ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ । ਇਸ ਉਪਰੰਤ ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਦੀ ਉੱਚ ਵਿਦਿਆ ਵਿਚ ਦਾਖਲਾ ਲੈਣ ਦੇ ਕਾਬਲ ਹੋ ਜਾਂਦੇਹਨ।ਇਸ ਦੇ ਨਾਲ ਹੀ ਵਿਭਿੰਨ ਖੇਤਰਾਂ ਵਿੱਚ ਨੌਕਰੀ ਕਰਨ ਦੇ ਕਾਬਲ ਹੋ ਜਾਂਦੇ ਹਨ।

2. ਪੋਸਟ ਗਰੈਜੂਏਟ ਪੱਧਰ ਤੇ ਕਾਲਜ ਵਿਚ ਪੰਜਾਬੀ ਦੀ ਐਮ. ਏ. ਕਰਵਾਈ ਜਾਂਦੀ ਹੈ , ਜਿਸ ਦੌਰਾਨ ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀ ਭਾਸ਼ਾ, ਸਾਹਿਤ ਅਤੇ ਸੱਭਿਆਚਾਰ ਦੇ ਅਧਿਐਨ ਵਿਚ ਪਰਪੱਕ ਕੀਤਾ ਜਾਂਦਾ ਹੈ । **(Scop)** ਐਮ. ਏ. ਪਾਸ ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਦੀ ਉਚੇਰੀ ਪੜ੍ਹਾਈ ਜਿਵੇਂ ਐਮ.ਫ਼ਿਲ , ਪੀ ਐਚ-ਡੀ. ਕਰਨ ਤੋਂ ਇਲਾਵਾ ਅਧਿਆਪਨ ਤਾ ਅਨੁਵਾਦ ਆਦਿ ਵੱਖ ਵੱਖ ਖੇਤਰਾਂ ਦੇ ਵਿਚ ਨੌਕਰੀ ਕਰਨ ਦੇ ਯੋਗ ਹੋ ਜਾਂਦੇ ਹਨ ।

ਐਮ. ਏ. ਦੇ ਚਾਰ ਸਮੈਸਟਰ ਹਨ ਅਤੇ ਹਰ ਸਮੈਸਟਰ ਦੇ ਚਾਰ ਪੇਪਰ ਹਨ

ਸਮੈਸਟਰ ਪਹਿਲਾ

- **ਪੇਪਰ ਪਹਿਲਾ : ' ਮੱਧਕਾਲੀ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦਾ ਇਤਿਹਾਸ '** ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ 1850 ਈ. ਤੱਕ ਦੇ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦੀਆਂ ਸਾਰੀਆਂ ਕਾਵਿ – ਧਾਰਾਵਾਂ ਦਾ ਇਤਿਹਾਸ ਮੂਲਕ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਦੂਜਾ : ' ਸਾਹਿਤ ਸਿਧਾਂਤ , ਸਨਾਤਨੀ ਕਾਵਿ - ਸ਼ਾਸਤਰ ਅਤੇ ਪੰਜਾਬੀ ਅਲੋਚਨਾ '** ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਸਾਹਿਤ ਦੀ ਪਰਕਿਰਤੀ ਅਤੇ ਪ੍ਰਯੋਜਨ ਨੂੰ ਸਮਝਣ ਲਈ ਗ੍ਰੀਕੋ ਰੋਮਨ ਕਾਵਿ – ਸ਼ਾਸਤਰ ਅਤੇ ਭਾਰਤੀ ਕਾਵਿ – ਸ਼ਾਸਤਰ ਦਾ ਦੀਰਘ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਤੀਜਾ : ' ਮੱਧਕਾਲੀ ਪੰਜਾਬੀ ਕਾਵਿ '** ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਮੱਧਕਾਲ ਦੇ ਤਿੰਨ ਪ੍ਰਮੁੱਖ ਕਵੀਆਂ ਦੀਆਂ ਰਚਨਾਵਾਂ ਦਾ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ –

1 ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਜੀ : ਜਪੁਜੀ
2 ਸ਼ਾਹ ਹੁਸੈਨ : ਕਾਫ਼ੀਆਂ
3 ਹਾਸ਼ਮ : ਸੱਸੀ ਪੁੰਨੂੰ

- **ਪੇਪਰ ਚੌਥਾ : ' ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਅਧਿਐਨ '** ਹੈ, ਇਸ ਪੇਪਰ ਵਿਚ ਪੰਜਾਬੀ ਦੇ ਤਿੰਨ ਪ੍ਰਮੁੱਖ ਕਹਾਣੀਕਾਰਾਂ ਸੰਤ ਸਿੰਘ ਸੇਖੋ, ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ ਅਤੇ ਵਰਿਆਮ ਸੰਧੂ ਦੀਆਂ ਕਹਾਣੀਆਂ ਦਾ ਦੀਰਘ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।

ਸਮੈਸਟਰ ਦੂਜਾ -

- **ਪੇਪਰ ਪੰਜਵਾਂ : ' ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦਾ ਇਤਿਹਾਸ '** ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ 1850 ਈ. ਤੋਂ ਲੈ ਕੇ ਹੁਣ ਤੱਕ ਦੇ ਸਮੁੱਚੇ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦਾ ਇਤਿਹਾਸ ਮੂਲਕ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ , ਜਿਸ ਵਿਚ ਪੰਜਾਬੀ ਕਵਿਤਾ, ਗਲਪ , ਨਾਟਕ ਅਤੇ ਵਿਭਿੰਨ ਵਾਰਤਕ ਰੂਪ ਸ਼ਾਮਿਲ ਹਨ।
- **ਪੇਪਰ ਛੇਵਾਂ : ' ਆਧੁਨਿਕ ਪੱਛਮੀ ਕਾਵਿ ਸ਼ਾਸਤਰ ਅਤੇ ਵਿਹਾਰਕ ਆਲੋਚਨਾ '** ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਰੂਸੀ ਰੂਪਵਾਦ , ਨਵ –ਅਮਰੀਕੀ ਸਕੂਲ , ਸੰਰਚਨਾਵਾਦ ਅਤੇ ਮਾਰਕਸਵਾਦੀ ਸਾਹਿਤ ਸਿਧਾਂਤ ਦਾ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ , ਮੱਧਕਾਲੀ -ਕਾਵਿ ਅਤੇ ਆਧੁਨਿਕ - ਕਾਵਿ ਦੀ ਵਿਹਾਰਕ ਅਲੋਚਨਾ ਦੀ ਸਿਖਲਾਈ ਦਿੱਤੀ ਜਾਂਦੀ ਹੈ।
- **ਪੇਪਰ ਸੱਤਵਾਂ : ' ਮੱਧਕਾਲੀ ਪੰਜਾਬੀ ਕਾਵਿ -।। '** ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਗੁਰੂ ਅਰਜਨ ਦੇਵ ਦੀ "ਸੁਖਮਨੀ " ਬੁੱਲ੍ਹੇ ਸ਼ਾਹ ਦੀਆਂ " ਕਾਫ਼ੀਆਂ" ਅਤੇ ਗੁਰੂ ਗੋਬਿੰਦ ਸਿੰਘ ਦੀ " ਚੰਡੀ ਦੀ ਵਾਰ" ਦਾ ਅਧਿਆਪਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਅੱਠਵਾਂ : ' ਪੰਜਾਬੀ ਅਤੇ ਪਰਵਾਸੀ ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਅਧਿਐਨ '** ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਦੋ ਭਾਰਤੀ ਪੰਜਾਬੀ ਕਹਾਣੀਕਾਰਾਂ ਅਤੇ ਇਕ ਪਰਵਾਸੀ ਕਹਾਣੀਕਾਰ ਦੀਆਂ ਕਹਾਣੀਆਂ ਦੇ ਅਧਿਐਨ ਰਾਹੀਂ ਸਮੁੱਚੀ ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਸਾਰ –ਤੱਤ ਸਮਝਾਉਣ ਦਾ ਯਤਨ ਕੀਤਾ ਜਾਂਦਾ ਹੈ।

ਸਮੈਸਟਰ ਤੀਜਾ –

- **ਪੇਪਰ ਨੌਵਾਂ :** ‘ **ਭਾਸ਼ਾ ਵਿਗਿਆਨ ਅਤੇ ਪੰਜਾਬੀ ਭਾਸ਼ਾ** ’ ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਭਾਸ਼ਾ ਦੇ ਸਿਧਾਂਤਾਂ ਨੂੰ ਸਮਝਾਉਣ ਦੇ ਨਾਲ ਭਾਸ਼ਾ ਦੇ ਵੱਖ – ਵੱਖ ਪੱਧਰਾਂ - ਪੰਜਾਬੀ ਧੁਨੀ ਵਿਗਿਆਨ , ਪੰਜਾਬੀ ਧੁਨੀ ਵਿਉਂਤ ਅਤੇ ਪੰਜਾਬੀ ਰੂਪ ਵਿਗਿਆਨ ਦਾ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਦਸਵਾਂ :** ‘ **ਸੱਭਿਆਚਾਰ , ਲੋਕਧਾਰਾ ਅਤੇ ਪੰਜਾਬੀ ਸੱਭਿਆਚਾਰ** ’ ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਸੱਭਿਆਚਾਰ ਅਤੇ ਲੋਕਧਾਰਾ ਦੇ ਸਿਧਾਂਤਕ ਪੱਖ ਅਤੇ ਪੰਜਾਬੀ ਸੱਭਿਆਚਾਰ ਦਾ ਅਧਿਆਪਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਗਿਆਰਵਾਂ :** ‘ **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਵਿਤਾ-**।’ ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਵਿਤਾ ਦੇ ਮੁੱਢਲੇ ਤਿੰਨ ਕਵੀਆਂ ਦੀਆਂ ਕਵਿਤਾਵਾਂ ਦੇ ਅਧਿਐਨ ਰਾਹੀਂ ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਵਿਤਾ ਦੇ ਅਰੰਭ ਅਤੇ ਵਿਕਾਸ ਬਾਰੇ ਅਧਿਆਪਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਬਾਰ੍ਹਵਾਂ :** ‘ **ਪੰਜਾਬੀ ਨਾਟਕ ਅਤੇ ਰੰਗਮੰਚ ਦਾ ਅਧਿਐਨ-**।’ ਹੈ, ਇਸ ਪੇਪਰ ਵਿਚ ਪੰਜਾਬੀ ਦੇ ਤਿੰਨ ਪ੍ਰਮੁੱਖ ਨਾਟਕਕਾਰਾਂ ਦੇ ਇੱਕ – ਇੱਕ ਨਾਟਕ ਦਾ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।

ਸਮੈਸਟਰ ਚੌਥਾ –

- **ਪੇਪਰ ਤੇਰ੍ਹਵਾਂ :** ‘ **ਭਾਸ਼ਾ ਵਿਗਿਆਨ ,ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ** ’ ਹੈ, ਇਸ ਪੇਪਰ ਵਿਚ ਪੰਜਾਬੀ ਦੇ ਵਾਕ ਵਿਗਿਆਨ ਅਤੇ ਅਰਥ ਵਿਗਿਆਨ ਦੇ ਨਾਲ -ਨਾਲ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੇ ਇਤਿਹਾਸ ਦਾ ਅਧਿਐਨ ਵੀ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ
- **ਪੇਪਰ ਚੌਦਵਾਂ :** ‘ **ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਲੋਕ ਸਾਹਿਤ** ’ ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਪੰਜਾਬੀ ਲੋਕ ਸਾਹਿਤ ਦੀਆਂ ਵੱਖ – ਵੱਖ ਵੰਨਗੀਆਂ ਦਾ ਅਧਿਆਪਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਪੰਦਰ੍ਹਵਾਂ :** ‘ **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਵਿਤਾ-**।। ’ ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਜਗਤਾਰ , ਪਾਸ਼ ਅਤੇ ਸੁਰਜੀਤ ਪਾਤਰ ਦੀ ਇਕ – ਇਕ ਕਾਵਿ – ਪੁਸਤਕ ਦੇ ਅਧਿਐਨ ਰਾਹੀਂ ਸਮੁੱਚੀ ਕਵਿਤਾ ਨੂੰ ਸਮਝਾਉਣ ਦਾ ਯਤਨ ਕੀਤਾ ਜਾਂਦਾ ਹੈ।
- **ਪੇਪਰ ਸੋਲਵਾਂ :** ‘ **ਪੰਜਾਬੀ ਨਾਟਕ ਅਤੇ ਰੰਗਮੰਚ ਦਾ ਅਧਿਐਨ-**।। ’ ਹੈ , ਇਸ ਪੇਪਰ ਵਿਚ ਚਰਨਦਾਸ ਸਿੱਧੂ , ਆਤਮਜੀਤ ਅਤੇ ਸਵਰਾਜਬੀਰ ਦੇ ਇਕ- ਇਕ ਨਾਟਕ ਦਾ ਅਧਿਐਨ ਕਰਵਾਇਆ ਜਾਂਦਾ ਹੈ।

DEPARTMENT OF SOCIOLOGY

Program Outcome:

The curriculum of the UG and PG Sociology Course (Honours and Programme) has been designed with UGC regulations in mind. The texts, the topics of the Honours and the Programme courses are spread out through six semesters (each semester comprising six months/90 Teaching Days) and keeping in mind the students' growing maturity and familiarity with the subject. The curriculum and the teaching-learning process involve methods to help students appreciate Sociology by being able to develop the critical thinking, necessary to analyze and understand more than what is available in the printed text. The department implements several innovative teaching methods to make learning fun and stress-free as far as practicable. Students will be ableto practice sociology as educated and civically engaged persons.

Program Specific Outcomes for Sociology:

1. Critical Thinking: Demonstrate critical thinking skills by analyzing and evaluating social, political, and/or cultural arguments, across a variety of areas such as inequality; social problems; and race, class, and gender.

2. Sociological Understanding: Demonstrate sociological understandings of phenomena.

3. Written and Oral Communication: Formulate effective and convincing written and/or oral arguments.

4. Social Theory: Demonstrate the ability to use several of the major classical and/or contemporary perspectives in social theory.

5. Research Methodology: Demonstrate the ability to use several of the major social science research methodologies.

6. Substantive Areas: The ability to demonstrate knowledge of some of the key substantive areas within the field of sociology.

Course outcome of all courses offered by each department:

Bachelor of Arts is a three year degree course (6 semesters) .It remains the basic degree for getting entry into professional careers. It is a comprehensive course encompassing various subjects thereby incorporating among students in-depth knowledge of the same. It emphasis on multidisciplinary approach. It is the basic requisite degree for higher studies. Those students who have interest in their particular subject should opt for Honors in the same.

Masters of Arts is a post-graduation level course which is of 2 years duration (4 semester).The students who have interest in particular subject should pursue in masters for attaining better knowledge. It helps in inculcating among students in-depth knowledge of their subject. It increases opportunities for future jobs and competitive examinations. It makes you expert in your domain and helps in attaining specialization. It also develops in you a research and analytical minded and helps inn pursuing doctorate degree. Masters in sociology aims at sensitizing students regarding the basic concepts and approaches used for explaining and understanding society. It helps in gaining in specialization in fields such as

family and gender, development, stratification, crime, deviance, population, social problems, media and culture and others.

The scope of Sociology is very vast. It has a multi-disciplinary approach and it has a great value especially in modern society. It attempts to study society in holistic manner as economic institutions, political institutions, religious institutions, education institutions etc are studied and fall all under the garb of sociology.

It exposes students to the writings of sociologists and also acquaint the students with the basic elements of social research and the major problems confronted by social scientists in arriving at objectivity and value neutrality. The study of sociology helps us to know not only our society and men but also others, their motives, aspirations, status, occupations, traditions, customs, culture, institutions etc. Sociological knowledge is necessary for understanding and planning of society. It is of great practical help in the sense, it keeps us up tpo date on modern social situations and developments. It makes us more alert towards the changes and developments that take place around us.

PG Department of Zoology

Department of Zoology offers undergraduate (B.Sc. Medical with Zoology as an elective subject apart from Chemistry, Botany and Biotechnology) and Postgraduate (M.Sc. Zoology and single subject 'Biology for Chemists' for M.Sc. Chemistry students) course in Zoology in accordance to the prescribed curriculum affiliated to Panjab University.

The courses BSc Medical and MSc Zoology cover all areas of animal biology starting from molecules to communities. Our degree course has been designed with a real understanding of what the world needs from zoologists and what zoologists need to pursue higher studies and professional career. From classroom lectures to benchmark laboratory experiments and extensive field studies, the course objective focuses to make students understand the basic concepts, fundamental principles and the scientific theories related to the subject Zoology and its relevance in day-to-day life. Above all, the courses aim to make students capable of thinking both critically and creatively to propose novel ideas in explaining facts and figures along with proposing new solutions to the problems.

Objectives:

Imparting quality education in Zoology has been the focus of the department right from its inception. Emphasis is given on education both within and outside the classroom.

The Department is dedicated to fulfil the following objectives through curricular and co-curricular activities:

- To inculcate value-based education and entrepreneurial skills among the students.
- To create awareness on environmental issues through various activities.
- To develop an empathic side to biodiversity.
- To provide students with a sound knowledge of fundamental principles in Zoology that will provide a foundation for future studies.
- To enable students to apply basic zoological principles in day-to-day life.
- To make students familiar with animal classification schemes.
- To integrate the laboratory and lecture sessions of the course into a wholesome learning experience and facilitate deeper learning.
- To provide quality education offering skill-based programmes and motivate the students for self-employment in the applied branches of Zoology.

B.Sc. Medical – Zoology

The syllabus pertaining to B.Sc. (General) of different semesters in the subject of Zoology has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of Zoology working in the Panjab University, Chandigarh and affiliated colleges through the Undergraduate Board of Studies. The syllabus contents are duly arranged section-wise as well as unit-wise. The contents are included in such a manner that due importance may be given to skill-oriented components. The Course also gives due stress upon excursion/field trips to Zoological Parks, Seashores, Hill Stations, Museum, Fossil Park and Apiary/Godowns for a better academic outlook. The Department of Zoology, P.U., Chandigarh

usually organizes workshop/seminars from time to time for updating the teachers. The minimum time required to complete the course is three years.

Programme Outcomes:

After successfully completing the B.Sc. Medical Programme, students will be able to:

PO1 Equip themselves with theoretical and practical knowledge about the subject, viz., Invertebrates, Vertebrates, Cell Biology, Ecology, Developmental Biology, Entomology, Animal Behaviour, Evolution, Genetics, Animal Physiology and Biochemistry and pursue research as a PhD student in any of the said field.

PO2 Pursue teaching jobs in schools by merely adding a B.Ed. degree to their resume.

PO3 Achieve higher education by pursuing Masters in Zoology, Biotechnology, Botany, Human Genomics, Stem Cell and Tissue Engineering, Bioinformatics and other allied courses from the field of Life Sciences.

PO4 Prepare for Indian Forest Service and other Civil Services exams at both National and State Level.

PO5 Work as Graduate Trainees in Research Projects and learn state-of-the-art techniques and methodologies.

PO6 Work in laboratories as Lab Attendants.

PO7 Attend Lab Technician Diploma Courses including Diploma in Medical Lab Technology (DMLT) and B.Sc. MLT.

PO8 Work as Medical Transcriptionists for healthcare practitioners.

PO9 Work as Academic Counsellors with various universities and colleges.

PO10 Become academic writers or content developers.

PO11 Teach at Coaching Centres meant for the preparation of competitive entrance exams.

PO12 Become Nutritionists or Dieticians by simply pursuing professional courses after BSc, enabling them to work with hospitals or at individual level.

PO13 Join environmental agencies in India and abroad such as Greenpeace, Sustainable Table etc.

PO14 Pursue career in pharmacy, veterinary sciences, Ayurveda, AYUSH etc.

PO15 Become an entomologist and work in agricultural industry or agricultural universities.

Programme Specific Outcomes:

After successfully completing BSc Medical Programme, students will be able to:

PSO1 Attain knowledge on complex life processes and phenomena essential for sustenance in daily routine.

PSO2 Acquire the skills in handling scientific instruments, planning and performing in laboratory experiments.

PSO3 Understand the significance of environment, sustainable development and conservation of natural resources.

PSO4 Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied zoology.

PSO5 Compare and contrast the characteristics of animals that differentiate them from other forms of life.

PSO6 Understand the structure and functions of cell types.

PSO7 Explain the role of various biomolecules in living systems.

Course Outcomes:

BSc Medical – Zoology – First Year – Semester I

Paper I – ZOO 101 – Biodiversity and Cell Biology – I

After successfully completing this course, students will be able to:

CO1 Demonstrate anatomical and physiological attributes of each animal group and why these have led to their success.

CO2 Identify and classify within a phylogenetic framework, a range of invertebrate animals from Protozoa, Porifera and Coelenterata.

CO3 Describe the morphology, physiology and life cycle of *Amoeba*, *Paramecium* and *Plasmodium* and explain the diversity among protists.

CO4 Describe the morphology, physiology and life cycle of *Scypha* and *Obelia* and explain the evolution of tissue level organization.

CO5 Demonstrate the working of light, phase contrast, transmission electron and scanning electron microscopes and understand their practical applications.

CO6 Explain the principles of fixation and staining and use them for histology-based studies.

CO7 Differentiate between prokaryotic and eukaryotic cells, and explain the organization of a typical animal cell.

CO8 Explain the structure of plasma membrane with particular reference to Fluid Mosaic Model and the various transport phenomena associated with it.

CO9 Locate and explain the structure and functioning of cellular organelles like endoplasmic reticulum, Golgi complex and mitochondria.

Paper II – ZOO 102 – Biodiversity and Cell Biology – II

After successfully completing this course, students will be able to:

CO1 Demonstrate anatomical and physiological attributes of each animal group and why these have led to their success.

CO2 Identify and classify within a phylogenetic framework, a range of invertebrate animals from Platyhelminthes, Aschelminthes and Annelida.

CO3 Describe the morphology, physiology, life cycle and harmful effects of different helminth parasites like *Fasciola, Taenia* and *Ascaris*.

CO4 Understand the parasitic adaptations in helminths.

CO5 Describe the morphology and physiology of *Pheretima* and explain the evolution of segmentation.

CO6 Locate and explain the structure and functioning of cellular organelles like lysosomes, ribosomes and centrosomes.

CO7 Describe the structure and function of nucleus along with its organization and genetic relevance.

CO8 Explain the underlying principles and cause of cancer along with a basic idea of cell transformation.

CO9 Differentiate between cellular and humoral immunity and have an elementary idea of cells and organs of immune system.

Practical – ZOO 151 – Practical based on Theory Papers ZOO 101 and ZOO 102

After successfully completing this course, students will be able to:

CO1 Classify various phyla from Protozoa till Annelida.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Prepare and examine the cultures of *Euglena*, *Paramecium* and *Vorticella*.

CO5 Identify stained slides of *Scypha* (T.S. and L.S.), gemmules, spicules, spongin fibres, *Hydra* (testis and ovary regions), *Fasciola* (T.S. various regions), *Ascaris* (male and female), *Pheretima* (pharyngeal and typhlosolar regions), setae, septal nephridia, spermathecae and ovary of *Pheretima*.

CO6 Demonstrate dissection of earthworm through video clippings/models/charts.

CO7 Prepare stained slides of sex chromatin through buccal smear.

CO8 Demonstrate the principle and working of gel electrophoresis, transmission and scanning electron microscopes.

CO9 Identify cell organelles, explain their ultrastructure and organization in a typical animal cell.

CO10 Identify stained slides of striated muscle fibre.

BSc Medical – Zoology – First Year – Semester II

Paper I – ZOO 201 – Biodiversity and Ecology – I

After successfully completing this course, students will be able to:

CO1 Demonstrate anatomical and physiological attributes of each animal group and why these have led to their success.

CO2 Identify and classify within a phylogenetic framework, a range of invertebrate animals from Phylum Arthropoda.

CO3 Describe the morphology, physiology and life cycle of *Periplaneta* and *Palaemon*.

CO4 Describe the social organization in honey bees and termites and understand the concept of eusociality.

CO5 Describe the life cycle of *Anopheles* and *Culex* and identify mosquitoes at genus level.

CO5 Explain the subdivisions and scope of Ecology.

CO6 Understand the components of ecosystem, ecological energetics, food web and identify major ecosystems of the world.

CO7 Describe the role of various ecological factors such as temperature, light and soil with special reference to limiting factors.

CO8 Illustrate the flow of nutrients in biogeochemical cycles.

CO9 Demonstrate the morphological, physiological and behavioural adaptations in animals in different habitats.

CO10 Explain the characteristics and regulation of population.

Paper II – ZOO 202 – Biodiversity and Ecology – II

After successfully completing this course, students will be able to:

CO1 Demonstrate anatomical and physiological attributes of each animal group and why these have led to their success.

CO2 Identify and classify within a phylogenetic framework, a range of invertebrate animals from Mollusca, Echinodermata and Hemichordata.

CO3 Describe the morphology, physiology and life cycle of *Pila, Asterias* and *Balanoglossus*.

CO4 Identify and explain the Echinoderm larvae.

CO5 Explain the affinities of Hemichordata with chordates and non-chordates.

CO6 Understand the inter- and intra-ecological relationships such as competition, predation, parasitism, commensalism, ammensalism and mutualism.

CO7 Describe the role of ecological niche and succession and various characteristics of biotic community.

CO8 Differentiate between renewable and non-renewable natural resources and focus on their conservation.

CO9 Identify the causes, impact and control of air, water, land and noise pollution.

CO10 Understand the basic concepts of biodiversity and differentiate between *ex situ* and *in situ* conservation strategies of wildlife.

Practical – ZOO 152 – Practical based on Theory Papers ZOO 201 and ZOO 202

After successfully completing this course, students will be able to:

CO1 Classify various phyla from Arthropoda till Hemichordata.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Identify permanent stained preparations of trachea and mouth parts of *Periplaneta*, radula and osphradium of *Pila*, and T.S. arm of Starfish.

CO5 Demonstrate through video clippings/models/charts, the dissection of digestive and nervous systems, trachea and mouth parts of *Periplaneta*.

CO6 Demonstrate through video clippings/models/charts, the dissection of digestive and nervous systems, pallial complex and radula of *Pila*.

CO7 Demonstrate the morphological, physiological and behavioural adaptations in animals in different habitats through preserved animals, charts or models.

CO8 Demarcate the zoogeographical realms on world map and categorize the endemic fauna as per the geographical distribution and climate.

CO9 Explain the biotic components of an ecosystem.

CO10 Identify the different types of nests in birds.

BSc Medical – Zoology – Second Year – Semester III

Paper I – ZOO 301 – Biodiversity (Chordates) and Evolution – I

After successfully completing this course, students will be able to:

CO1 Demonstrate anatomical and physiological attributes of each animal group and why these have led to their success.

CO2 Identify and classify within a phylogenetic framework, a range of chordate animals from Urochordata, Cephalochordata and Vertebrata (Cyclostomata, Pisces and Amphibia).

CO3 Describe the morphology, physiology and life cycle of *Herdmania*, *Amphioxus*, *Petromyzon*, *Labeo* and *Hoplobatrachus tigerinus* (frog).

CO4 Describe the origin, migration and parental care in chordates.

CO5 Explain the affinities of Class Cyclostomata.

CO6 Identify and categorize fishes on the basis of scales and fins.

CO7 Understand the concept and evidences of organic evolution.

CO8 Explain the various theories associated to organic evolution.

CO9 Demonstrate the origin of life.

Paper II – ZOO 302 – Biochemistry and Physiology – I

After successfully completing this course, students will be able to:

CO1 Understand the scope of Biochemistry.

CO2 Classify and assign functions to carbohydrates, proteins, lipids and nucleic acids.

CO3 Classify and nomenclate enzymes on the basis of their nature, mode of action, presence of coenzymes and cofactors.

CO4 Describe the carbohydrate metabolism through glycolysis, Krebs' Cycle, hexose monophosphate shunt, glycogenesis and glycogenolysis.

CO5 Explain the physiology of extra- and intracellular digestion and nutrition.

CO6 Illustrate the regulation of digestive processes and symbiotic digestion.

CO7 Describe the physiology of respiration through exchange and transport of gases.

CO8 Understand basic concepts of respiration such as Bohr Effect, Chloride Shift and Haldane Effect.

CO9 Explain the structure and function of haemoglobin with reference to oxygen dissociation curve.

CO10 Demonstrate the composition and functions of blood and lymph.

CO11 Explain the dynamics of blood clotting, blood groups and Rh factor.

CO12 Describe the working of heart, regulation of heart beat and cardiac cycle.

CO13 Define electrocardiogram, cardiac output, blood pressure and microcirculation.

Practical – ZOO 251 – Practical based on Theory Papers ZOO 301 and ZOO 302

After successfully completing this course, students will be able to:

CO1 Classify various phyla: Urochordata, Cephalochordata and Vertebrata including classes Cyclostomata, Pisces and Amphibia.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Demonstrate through video clippings/models/charts, the dissection of *Herdmania*.

CO5 Demonstrate through video clippings/models/charts, the dissection of digestive, circulatory, nervous and reproductive systems of *Labeo*.

CO6 Demonstrate the skeletal systems of *Labeo* and *Hoplobatrachus* (frog).

CO7 Identify permanent stained slides of spicules and pharynx of *Herdmania*.

CO8 Identify permanent stained slides of T.S. *Amphioxus* through various regions.

CO9 Identify permanent stained slides of histology of frog (compound tissues).

CO10 Record human blood pressure.

CO11 Estimate haemoglobin content in human blood.

CO12 Detect the presence of salivary amylase in saliva and observe its denaturation by pH and temperature.

CO13 Prepare report on fossils entailing a visit to fossil park.

CO14 Familiarize themselves local vertebrate fauna and museum animals.

BSc Medical – Zoology – Second Year – Semester IV

Paper I – ZOO 401 – Biodiversity (Chordates) and Evolution – II

After successfully completing this course, students will be able to:

CO1 Demonstrate anatomical and physiological attributes of each animal group and why these have led to their success.

CO2 Identify and classify within a phylogenetic framework, a range of chordate animals from Vertebrata viz., Reptilia, Aves and Mammalia.

CO3 Describe the morphology, physiology and life cycle of *Uromastix*, *Columba* and *Rattus*.

CO4 Differentiate between poisonous and non-poisonous snakes and explain the poison apparatus.

CO5 Understand the volant (flight) adaptations in birds.

CO6 Explain dentition patterns in mammals.

CO7 Understand the concept micro-, macro- and mega-evolution.

CO8 Understand the biological concept of species.

CO9 Demonstrate the types of fossils with their dating.

CO10 Describe the evolution of man.

Paper II – ZOO 402 – Biochemistry and Physiology – II

After successfully completing this course, students will be able to:

CO1 Describe the lipid metabolism through beta oxidation of fatty acids, fate of glycerol, gluconeogenesis, lipogenesis and ketosis.

CO2 Grasp the concept of wholesomeness of metabolism through anaplerotic interaction between carbohydrates and lipids.

CO3 Explain protein metabolism through protein hydrolysis and ornithine cycle.

CO4 Describe amino acid metabolism via oxidative deamination, transamination and decarboxylation.

CO5 Describe the structure and types of nephron, urine formation and composition.

CO6 Explain the physiology of osmoregulation and counter-current mechanism.

CO7 Explain the structure and function of haemoglobin with reference to oxygen dissociation curve.

CO8 Describe the ultrastructure of muscles.

CO9 Explain the chemical and physiological basis of skeletal muscle contraction.

CO10 Discuss the neuronal structure physiology, various potentials, and origin and propagation of nerve impulse.

CO11 Describe synapse and myoneural junction.

CO12 Explain the structure, hormones and functions of various endocrine glands.

Practical – ZOO 252– Practical based on Theory Papers ZOO 401 and ZOO 402

After successfully completing this course, students will be able to:

CO1 Classify the classes Reptilia, Aves and Mammalia under phylum Vertebrata.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Demonstrate through video clippings/models/charts, the dissection of *Herdmania*.

CO5 Demonstrate through video clippings/models/charts, the dissection of digestive, circulatory, and urinogenital systems of Chick.

CO6 Demonstrate through video clippings/models/charts, the dissection of digestive, circulatory, and urinogenital systems of White Rat.

CO7 Demonstrate the skeletal systems of *Varanus, Gallus* and *Oryctolagus/Rattus*.

CO8 Identify permanent stained slides of histology of rat/rabbit (compound tissues).

CO9 Prepare and examine the blood smear of a mammal.

CO10 Identify macromolecules – starch, glucose, proteins and fats – in solutions of food stuff.

CO11 Demonstrate osmosis and diffusion.

CO12 Analyse urine for the presence of urea, chloride, glucose and uric acid.

CO13 Locate and illustrate diagrammatically the endocrine glands in human beings.

CO14 Trace human evolution through models and charts.

CO15 Prepare report on fossils entailing a visit to fossil park.

CO16 Familiarize themselves local vertebrate fauna and museum animals.

BSc Medical – Zoology – Third Year – Semester V

Paper I – ZOO 501 – Developmental Biology

After successfully completing this course, students will be able to:

CO1 Compare and contrast spermatogenesis and oogenesis.

CO2 Describe egg maturation, egg membranes and polarity of egg.

CO3 Explain the concept of fertilization and parthenogenesis.

CO4 Illustrate the types of eggs and cleavage patterns.

CO5 Describe blastula formation and its types.

CO6 Demonstrate fate maps of chick and frog embryos.

CO7 Understand the role of organizers and inducers during development of an organism.

CO8 Understand the concepts of determination and differentiation.

CO9 Explain cell-cell interactions (juxtacrine, paracrine) and gap junctions.

CO10 Describe development in *Herdmania*, *Amphioxus,* frog, chick and rabbit up to three germ layers.

CO11 Describe the role and formation of foetal membranes.

CO12 Explain the formation, types and functions of mammalian placenta.

CO13 Describe metamorphosis in *Herdmania* and *Rana*.

Practical – ZOO 351 – Practical based on Theory Paper ZOO 501 (Developmental Biology)

After successfully completing this course, students will be able to:

CO1 Explain development of frog through permanent slides.

CO2 Prepare permanent slides of chick embryo stages through window method.

CO3 Identify developmental stages of chick embryo through permanent slides.

CO4 Identify various stages of gametogenesis through permanent slides.

CO5 Identify and illustrate the structure of mammalian egg and sperm.

CO6 Identify and illustrate the structure of larva of *Herdmania*.

CO7 Demonstrate the process of metamorphosis in *Herdmania* and frog.

Paper II – ZOO 502B – Economic Entomology and Pest Management – I

After successfully completing this course, students will be able to:

CO1 Enlist various orders of insects with examples.

CO2 Compare mouth parts in grasshopper, honey bee, butterfly, red cotton bug, housefly and mosquito.

CO3 Identify modifications in legs and antennae of insects.

CO4 Describe different types of metamorphosis in insects.

CO5 Illustrate different types of larvae and pupae.

CO6 Explain systematic position, habits, habitat and nature of damage of pests of sugarcane, cotton, paddy, wheat and vegetables.

CO7 Explain systematic position, habits, habitat and nature of damage of pests of stored grains.

CO8 Explain systematic position, disease caused and control of pests of medical and veterinary importance.

Practical – ZOO 352B – Practical based on Theory Paper ZOO 502B (Economic Entomology and Pest Management – I)

After successfully completing this course, students will be able to:

CO1 Identify and explain morphology of pests of sugarcane, cotton, paddy, wheat and vegetables.

CO2 Identify and explain morphology of damage of pests of stored grains.

CO3 Identify and explain morphology of pests of medical and veterinary importance.

CO4 Identify and illustrate the types of larvae and pupae of insects.

CO5 Prepare life cycle reports of insects of choice.

BSc Medical – Zoology – Third Year – Semester VI

Paper I – ZOO 601 – Genetics

After successfully completing this course, students will be able to:

CO1 Explain Mendel's laws of inheritance, Mendelian ratios, modifications of Mendelian ratios, non-allelic gene interaction and modified F_2 ratios.

CO2 Describe multiple allelism through blood group inheritance, eye colour in *Drosophila*.

CO3 Explain the concepts of pseudo-allelism and inheritance of quantitative traits (skin colour inheritance in man).

CO4 Discuss and correlate the phenomena of linkage, crossing over and recombination.

CO5 Understand the inheritance of sex-linked characters, synaptonemal complex and tetrad analysis.

CO6 Explain the structure of DNA and RNA.

CO7 Describe the genetic code, principles of codon assignment and wobble hypothesis.

CO8 Illustrate the mechanism of replication, transcription and translation.

CO9 Discuss the extranuclear inheritance of Kappa particles in *Paramecium*.

CO10 Describe the gene mutations and chromosomal aberrations with associated diseases.

CO11 Explain carcinogenesis and inborn errors of metabolism in man.

CO12 Understand the mechanism of regulation of gene expression in prokaryotes and eukaryotes.

CO13 Understand gene frequencies and population genetics.

CO14 Solve the problems based on Hardy-Weinberg Law.

CO15 Describe genetic recombination in bacteria via conjugation, transformation and transduction.

CO16 Explain Recombinant DNA Technology, Genetic Cloning and DNA Fingerprinting.

CO17 Enlist applications of Genetic Engineering in medicine and agriculture.

Practical – ZOO 353 – Practical based on Theory Paper ZOO 601 (Genetics)

After successfully completing this course, students will be able to:

CO1 Solve the numerical problems based on Mendelian Laws of segregation and independent assortment and epistasis.

CO2 Demonstrate mechanism of segregation in corn kernels.

CO3 Demonstrate cytoplasmic inheritance in flowers of *Mirabilis jalapa*.

CO4 Investigate gene frequencies based on PTC tasting in human population.

CO5 Compare variance with respect to pod length and number of seeds in pea pod.

CO6 Calculate gene frequencies and random mating using coloured beads.

CO7 Describe polytene chromosomes of salivary glands of *Chironomus*.

CO8 Demonstrate Dermatoglyphics through palm print taking and fingertip patterns.

Paper II – ZOO 602B – Economic Entomology and Pest Management – II

After successfully completing this course, students will be able to:

CO1 Define the concepts of the applied subjects like apiculture, sericulture and lac culture.

CO2 Identify the different species of honeybees, silkworm and lac insect along with their host plants.

CO3 Explain the tools and techniques used in apiculture, sericulture and lac culture.

CO4 Explain the important pests and diseases affecting honeybees, silkworm and lac insect.

CO5 Describe the economic importance of apiculture, sericulture and lac culture.

CO6 Illustrate management of the apiary, sericulture and lac culture units.

CO7 Classify different categories of insecticides used in chemical control of insects.

CO8 Describe biological methods of pest control.

CO9 Achieve a thorough understanding of Integrated Pest Management.

Practical – ZOO 354B – Practical based on Theory Paper ZOO 602B (Economic Entomology and Pest Management – II)

After successfully completing this course, students will be able to:

CO1 Identify and compare mouth parts of honey bee, butterfly and red cotton bug.

CO2 Identify and illustrate the types of antennae, legs and wings of insects.

CO3 Describe life cycle stages of silk worm, honey bee and lac insect.

CO4 Understand the structure and working of common sprayers like Hand Compression and Knap Sack Sprayer.

CO5 Visit godowns to study infestation and prepare reports.

CO6 Observe the various tools, crafts and gears used in an Apiary.

Programme Outcomes, Programme Specific Outcomes and Course Outcomes of M.Sc. in Zoology

M.Sc. Zoology Programme

The MSc Zoology Programme, deals with the scientific study of animal kingdom including the structure, physiology, classification, taxonomy, biosystematics, embryology, evolution, behaviour, habits, habitat and distribution of all animals. The theoretical part of the course pertains to general principles of classical as well as modern zoology. The course also provides the student with an introduction to recent advances in Zoology in the areas of Animal Ecology, Immunology, Endocrinology and Neural Biology, Cell and Molecular Biology, Biochemistry and Cytogenetics. Those looking forward to establishing small-scale industry may get a dash of Fisheries, Aquaculture, Sericulture, Apiculture, Lac Culture and Parasitology to build a foundation upon.

The practicals are designed in such a way so as to provide a peek into the molecular world rendering students with a desire to step into research. The course also entails educational excursions to Zoological Parks, Butterfly Park, Instrumentation Laboratories, Seashores, Hill Stations, Museums, Fossil Park, Apiary and Godowns. The minimum time required to complete the course is two years.

Programme Outcomes:

After successfully completing the M.Sc. Zoology Programme, students will be able to:

PO1 Equip themselves with theoretical and practical knowledge about the subject, viz., Invertebrates, Vertebrates, Cell Biology, Ecology, Developmental Biology, Entomology, Animal Behaviour, Evolution, Genetics, Animal Physiology and Biochemistry.

PO2 Pursue teaching jobs in the Assistant Professor cadre at schools by merely adding a B.Ed. degree to their resume.

PO3 Achieve higher education by pursuing M.Phil and Ph.D. in Zoology, Biotechnology, Human Genomics, Stem Cell and Tissue Engineering, Bioinformatics and other allied fields belonging to Life Sciences.

PO4 Prepare for Indian Forest Service and other Civil Services exams at both National and State Level.

PO5 Clear entrance exams like UGC, CSIR, ICMR, GATE, DBT etc., enabling them to join doctorate courses with stipend.

PO6 Work as Research Associate or Junior Research Fellow in Scientific Projects and learn state-of-the-art techniques and methodologies.

PO7 Pursue career in Pharmacy and Veterinary Sciences.

PO8 Work as Medical Transcriptionists for healthcare practitioners.

PO9 Work as Academic Counsellors with various universities and colleges.

PO10 Become free-lance academic writers for newspapers, magazines or develop their own blogsites.

PO11 Become editors for newspaper columns or national magazines related to biodiversity.

PO12 Teach at coaching centres meant for preparation of competitive entrance exams.

PO13 Become nutritionists or dieticians by simply pursuing professional courses after BSc, enabling them to work with hospitals or at individual level.

PO14 Become part of Food Corporation of India and work as food quality inspectors.

PO15 Join environmental agencies in India such as Zoological Survey of India, Ministry of Environment and Forests etc.

PO16 Become active volunteers or members of non-governmental environment organizations in India and abroad such as Greenpeace, Sustainable Table etc.

Programme Specific Outcomes:

After successfully completing the M.Sc. Zoology Programme, students will be able to:

PSO1 Learn about various systems which are essential for sustenance of life and apply the knowledge to the understanding of complex life processes and phenomena in day-to-day life.

PSO2 Understand the importance of Environment, Sustainable Development and Conservation of Natural Resources.

PSO3 Explain the hierarchy of life by knowing how the organisms function at the level of the gene, genome, cell, tissue, organ and organ-system.

PSO4 Develop expertise in handling model organisms for the experimental purpose.

PSO5 Establish small-scale industries by applying zoological knowledge of branches like apiculture, sericulture, lac culture, aquaculture, medical entomology and agriculture etc.

PSO6 Develop proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization.

Course Outcomes:

M.Sc. Zoology – First Year – Semester I

Paper I – Theory – Structure and Functions of Invertebrates – I

After successfully completing this course, students will be able to:

CO1 Develop knowledge of classification and general organization of invertebrates.

CO2 Explain the habitat, habits, morphology and economic importance of invertebrates belonging to various phyla – Protozoa, Porifera, Coelenterata, Platyhelminthes and Aschelminthes.

CO3 Compare feeding, locomotory organelles and locomotion and reproduction in genera of Protozoa.

CO4 Enlist parasitic and pathogenic protozoans.

CO5 Describe canal system, skeleton and development in Porifera.

CO6 Describe polymorphism and alternation of generations in Coelenterata, and corals and coral reefs.

CO7 Compare and contrast the body wall, digestive, excretory and reproductive systems in genera of Platyhelminthes.

CO8 Illustrate life cycles of *Fasciola, Schistosoma, Taenia* and *Echinococcus*.

CO9 Illustrate life cycles of *Ascaris lumbricoides, Wuchereria bancrofti* and *Dracunculus medinensis*.

Paper I – Practical – Structure and Functions of Invertebrates – I

After successfully completing this course, students will be able to:

CO1 Grasp knowledge on general organization of invertebrate phyla – Protozoa, Porifera, Coelenterata, Platyhelmnithes and Aschelminthes.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Prepare and examine the cultures of *Amoeba*, *Euglena*, *Paramecium* and *Vorticella*.

CO5 Identify permanent stained slides of *Scypha* (T.S. and L.S.), gemmules, spicules, *Hydra* (testis and ovary regions), *Obelia* (colony, medusa and polyp), *Taenia* (scolex and proglottids), and *Ascaris* (male and female).

CO6 Prepare slides of gemmules and spicules of sponges.

CO7 Prepare permanent stained slides of coelenterates – *Hydra, Obelia, Sertularia* and *Plumularia*.

CO8 Prepare permanent stained slides of amphistomes and proglottids of a cestode.

Paper II – Theory – Lower Chordates, Comparative Anatomy of Vertebrates – I

After successfully completing this course, students will be able to:

CO1 Develop knowledge of classification and general organization of vertebrates.

CO2 Draw a comparative account of anatomy of vertebrates belonging to Urochordata, Cephalochordata and Vertebrata and understand their evolutionary trends.

CO3 Enlist affinities of *Herdmania* and *Amphioxus*.

CO4 Compare and contrast the integumentary system and its derivatives from Pisces to Mammals.

CO5 Explain skeletal system with detailed accounts of chondrocranium, splanchnocranium, dermatocranium and jaw suspensions.

CO6 Compare and contrast the digestive system from Pisces to Mammals with reference to dentition, gut anatomy and digestive glands.

CO7 Compare and contrast the circulatory system from Pisces to Mammals with reference to evolution of heart and aortic arches.

Paper II – Practical – Lower Chordates, Comparative Anatomy of Vertebrates – I

After successfully completing this course, students will be able to:

CO1 Grasp knowledge on general organization of vertebrate classes – Chondrichthyes, Osteichthyes, Amphibia and Reptilia.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Demonstrate dissection of *Labeo*.

CO5 Demonstrate the skeletal systems of *Labeo, Rana* and *Varanus*.

CO6 Identify the histological peculiarities in frog.

CO7 Understand the poison apparatus in snakes.

Paper III – Theory – Animal Physiology

After successfully completing this course, students will be able to:

CO1 Develop knowledge of physiological processes going on in animal/human body like digestion, respiration, blood circulation, excretion and muscle contraction.

CO2 Understand stress physiology and adaptations in response to temperature, altitude and deep-sea environment.

CO3 Explain chemistry, metabolic role and sources of vitamins and minerals and associated diseases of their deficiency.

CO4 Describe blood composition, blood clotting, blood pressure and maintenance of homeostasis.

CO5 Describe biochemistry of haemoglobin and myoglobin.

CO6 Explain mechanisms of cardiac cycle, cardiac output and microcirculation.

CO7 Explain the underlying principles of respiratory exchange and transport of gases

CO8 Define concepts of acidosis, alkalosis and regulation of pH.

CO9 Enlist the types of nitrogenous wastes.

CO10 Illustrate the concept of osmotic regulation and counter-current mechanism of kidney.

CO11 Enlist the types of muscles and explain their contraction mechanisms at biochemical level.

Paper III – Practical – Animal Physiology

After successfully completing this course, students will be able to:

CO1 Demonstrate the optimum activity of salivary amylase at various temperatures and pH.

CO2 Estimate haemoglobin content in human blood.

CO3 Determine TLC, DLC, ESR and RBC Count in human blood.

CO4 Determine the bleeding and clotting time of human blood.

CO5 Determine blood groups and Rh factor.

CO6 Measure blood pressure.

CO7 Estimate Micro and Macro-Haematocrit value of human blood.

CO8 Demonstrate the effect of exercise on cardiovascular and respiratory systems.

CO9 Estimate the level of glucose in human blood.

Paper IV – Theory – Ecology and Animal Behaviour

After successfully completing this course, students will be able to:

CO1 Acquaint themselves with the habitat and interactions of diverse animal groups with their environment.

CO2 Familiarize themselves with characteristic behavioural aspects of animal life.

CO3 Understand the subdivisions and scope of ecology.

CO4 Understand the effect of temperature, light and soil as abiotic ecological factors

CO5 Justify the principles of limiting factors.

CO6 Explain ecosystem dynamics and energy flow along with major ecosystems of the world.

CO7 Describe the resilience of ecosystem and ecosystem management.

CO8 Illustrate the flow of nutrients through various biogeochemical cycles – gaseous and sedimentary.

CO9 Describe population characteristics and regulation.

CO10 Explain characteristics of biotic community, ecological succession and ecological niche.

CO11 Explain biosphere, biomes and impact of climate on biomes.

CO12 Enlist various ecological adaptations in desert, aerial, fossorial and aquatic animals.

CO13 Demonstrate the importance of modifications in animal for their survival.

CO14 Understand the feeding, learning, instinctive, social and sexual behaviour of animals.

CO15 Describe the concepts of Circadian rhythm, mimicry and protective colouration.

CO16 Demonstrate migration of fishes and birds and parental care in animals.

CO17 Explain various intra- and inter-specific ecological relationships.

Paper IV – Practical – Ecology and Animal Behaviour

After successfully completing this course, students will be able to:

CO1 Observe phototactic and geotactic behaviour in insects.

CO2 Demonstrate types of nests and nesting habits in birds.

CO3 Demonstrate soil fauna.

CO4 Determine the pH, moisture content and salinity of the soil.

CO5 Observe desert, aquatic and aerial adaptations in animals.

CO6 Acquaint themselves with various biotic components of an ecosystem.

Paper V – Theory – Biostatistics & Computer Applications

After successfully completing this course, students will be able to:

CO1 Understand basic concepts of statistics applicable in biological studies.

CO2 Progress towards become more computer literate in order to use the vast store of knowledge on the internet.

CO3 Use computers in a better way for their studies.

CO4 Classify and graphically represent the given data.

CO5 Explain the application of sampling in biological sciences.

CO6 Explain standard probability distributions.

CO7 Explain the concept and means of central tendency.

CO8 Illustrate the means of dispersion with examples.

CO9 Learn about coefficient of variation, standard error and confidence interval.

CO10 Use statistical significance tests like Chi-square test, Z-test, F-test and Student's t-test.

CO11 Apply ANOVA, correlation and regression to analyse biological data.

CO12 Demonstrate computer hardware.

CO13 Use software for writing research articles and preparing project reports.

CO14 Acquaint themselves with programming in C and Fortran language.

Paper V – Practical – Biostatistics & Computer Applications

After successfully completing this course, students will be able to:

CO1 Calculate dispersion, measures of central tendency.

CO2 Fit binomial and Poisson distributions to biological data.

CO3 Apply tests of statistical significance on biological samples.

CO4 Write programme to demonstrate conditional statements using C language.

CO5 Perform mail merge, send emails and use Internet.

CO6 Use MS Word, Excel and PowerPoint.

M.Sc. Zoology – First Year – Semester II

Paper VI – Theory – Structure and Functions of Invertebrates – II

After successfully completing this course, students will be able to:

CO1 Develop knowledge of classification and general organization of invertebrates.

CO2 Explain the habitat, habits, morphology and economic importance of invertebrates belonging to various phyla – Annelida, Arthropoda, Mollusca, Echinodermata and some minor phyla.

CO3 Compare segmentation, digestive, excretory and reproductive systems in genera of Annelida.

CO4 Enlist and identify various larval forms of crustaceans.

CO5 Illustrate various types of mouth parts, wings and legs in insects.

CO6 Describe social organisation in termites, honey bees and ants.

CO7 Compare and contrast feeding, respiration, shell diversity, podium or foot, torsion and detorsion in genera of Mollusca.

CO8 Compare the water vascular, haemal and perihaemal systems in Echinodermata.

CO9 Enlist and identify various life forms in Echinodermata.

CO10 Understand the concept and significance of minor phyla – Rotifera, Gastrotricha, Kinorhyncha and Nematomorpha.

Paper VI – Practical – Structure and Functions of Invertebrates – II

After successfully completing this course, students will be able to:

CO1 Grasp knowledge on general organization of invertebrate phyla – Annelida, Arthropoda, Mollusca and Echinodermata.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Demonstrate dissections of *Pheretima*, *Palaemon*, *Anodonta* and *Asterias*.

CO5 Identify permanent stained slides of *Pheretima* (T.S. typhlosolar region), setae, types of nephridia, parapodia of *Nereis* and Leech (T.S. through different regions).

CO6 Identify and illustrate gill and statocyst of Prawn, trachea of insect, mouth parts of cockroach, mosquito, honeybee, housefly and butterfly.

CO6 Identify permanent stained slides of Glochidium larva, radula of *Pila*, gill lamina of *Anodonta*.

CO7 Identify permanent stained slides of T.S. arm of Starfish, tube feet and larval forms of Echinodermata.

Paper VII – Theory – Comparative Anatomy of Vertebrates – II

After successfully completing this course, students will be able to:

CO1 Draw a comparative account of anatomy of vertebrates from Pisces to Mammals and understand their evolutionary trends.

CO2 Compare and contrast the types of respiratory organs and their mechanisms from Pisces to Mammals.

CO3 Compare and contrast the urinogenital system from Pisces to Mammals with reference to succession of kidney, osmoregulation and evolution of gonads and urinogenital ducts.

CO4 Compare and contrast the nervous system from Pisces to Mammals with reference to evolution of brain, spinal cord and cranial nerves.

CO5 Compare sense organs, chemoreceptors, photoreceptors and mechanoreceptors from Pisces to Mammals.

Paper VII – Practical – Comparative Anatomy of Vertebrates – II

After successfully completing this course, students will be able to:

CO1 Grasp knowledge on general organization of vertebrate classes – Aves and Mammalia.

CO2 Identify and classify up to orders, the various animals based on morphological features.

CO3 Understand the economic importance of animals in the above-mentioned groups.

CO4 Demonstrate dissections of Chick and White Rat.

CO5 Demonstrate the skeletal systems of *Gallus* and *Oryctolagus*.

CO6 Identify the histological peculiarities in frog and rat/rabbit.

CO7 Understand the concept of Bird Migration.

Paper VIII – Theory – Biosystematics and Evolution

After successfully completing this course, students will be able to:

CO1 Identify, classify and name organisms according to the International Code of Zoological Nomenclature (ICZN).

CO2 Describe the concepts of systematics, classification and taxonomy.

CO3 Explain the principles of zoological classification and nomenclature.

CO4 Decipher different types of taxonomic keys to identify organisms.

CO5 Understand higher taxa and Linnean hierarchy.

CO6 Discuss history and theories of classification.

CO7 Understand the concept of speciation, origin of life and evolution.

CO8 Understand the biological species concept.

CO9 Differentiate between species, subspecies, semi- and super-species, race, variety and cline.

CO10 Justify the inclusion of a given organism in a given phylum.

CO11 Explain the mutation theory of evolution, natural selection, sexual selection and co-evolution.

CO12 Justify the interrelationship among different phyla of Invertebrates and their evolutionary significance.

CO13 Learn the origins of vertebrates from Pisces, Amphibia, Reptilia, Aves to Mammalia.

CO14 Trace the ancestry of man, horse, camel and elephant.

Paper VIII – Practical – Biosystematics and Evolution

After successfully completing this course, students will be able to:

CO1 Identify fishes using taxonomic keys and characters.

CO2 Identify and describe common insects using taxonomic keys and characters.

CO3 Trace the ancestry of man, horse, camel and elephant.

CO4 Visit fossil parks and Geology and Anthropology museums and illustrate the presence of organisms at various geological time scales.

CO5 Compare origin of invertebrate and vertebrate groups.

Paper IX – Theory – Endocrinology and Neural Physiology

After successfully completing this course, students will be able to:

CO1 Understand the functions of hormones and their mode of action at molecular level.

CO2 Explain the chemical nature of hormones, steroid hormones, amino acid derived hormones, catecholamines and peptide hormones.

CO3 Illustrate the mechanism of hormone action and role of hormone receptors.

CO4 Outline the autocrine, paracrine and telocrine regulation of hormones.

CO5 Discuss the roles of hormones from pituitary gland, hypothalamus and pineal body.

CO6 Discuss the roles of hormones from thyroid, parathyroid and adrenal glands.

CO7 Discuss the roles of hormones from pancreas and gastro-intestinal tract.

CO8 Explain hormonal regulation of biomolecules and mineral metabolism

CO9 Enlist and explain prostaglandins, their synthesis and biological functions.

CO10 Justify the endocrine control of spermatogenesis, oogenesis and folliculogenesis in mammals.

CO11 Illustrate neuronal physiology and its dynamics.

CO12 Enlist and describe neurotransmitters and their underlying molecular mechanisms.

CO13 Justify the location and structure of eye, ear, nose and taste buds to their functions.

Paper IX – Practical – Endocrinology and Neural Physiology

After successfully completing this course, students will be able to:

CO1 Identify various stages of oestrous cycle.

CO2 Justify the location and functioning of endocrine glands in mammals.

CO3 Prepare permanent histology slides from testis, pancreas and adrenal glands of goat/sheep.

CO4 Understand the histological peculiarities of endocrine glands.

CO5 Explain the corrective measures for myopia, hypermetropia, astigmatism and cataract.

CO6 Demonstrate the structure of eye and ear.

CO7 Enlist and demonstrate the different types of neurons.

Paper X – Theory – Immunology

After successfully completing this course, students will be able to:

CO1 List the primary and secondary immune organs.

CO2 Describe antigens, epitopes, haptens and adjuvants.

CO3 Enlist types of immunoglobulins with basic structure and functions.

CO4 Differentiate between cellular and humoral immunity; primary and secondary immune response; and T and B cells.

CO5 Compare the MHC molecules and diseases associated with HLA.

CO6 Explain the Complement system, its activation, regulation and biological effects.

CO7 Understand antigen-antibody interactions such as precipitation and agglutination.

CO8 Demonstrate the principle and application of the common techniques used in Immunology such as radioimmunoassay, ELISA, immunofluorescence, immunoprecipitation, flow cytometry.

CO9 Demonstrate Northern, Southern and Western Blotting.

Paper X – Practical – Immunology

After successfully completing this course, students will be able to:

CO1 Detect the human blood groups by agglutination reactions.

CO2 Prepare human blood smear to identify various types of white blood cells.

CO3 Compare blood smears of normal and diseased individuals.

CO4 Identify the microscopic structure of different lymphoid organs.

CO5 Demonstrate Ouchterlony diffusion assay.

CO6 Demonstrate the technique of ELISA.

M.Sc. Zoology – Second Year – Semester III

Paper XI – Theory – Developmental Biology – I

After successfully completing this course, students will be able to:

CO1 Describe the key events in early and systematic embryological development.

CO2 Understand the pattern of development at molecular level.

CO3 Define basic concepts of development – potency, commitment, specification and induction.

CO4 Understand the concepts of competence, determination and differentiation.

CO5 Differentiate between instructive and permissive interactions.

CO6 Understand molecular basis of differentiation, transdifferentiation and dedifferentiation.

CO7 Demonstrate cleavage patterns and fate maps in Tunicates, *Drosophila*, Amphibia, Chick and *Caenorhabditis elegans*.

CO8 Explain gene regulation and development in *Drosophila*.

CO9 Compare and contrast spermatogenesis and oogenesis.

CO10 Enumerate the molecular events during fertilization.

CO11 Describe formation of zygote, blastula, embryonic fields, gastrulation and germ layers.

CO12 Understand the concept of regeneration.

Paper XI – Practical – Developmental Biology – I

After successfully completing this course, students will be able to:

CO1 Identify developmental stages in frog and chick embryo.

CO2 Demonstrate spermatogenesis of rat and grasshopper.

CO3 Identify types of eggs in animals.

Paper XII – Theory – Biochemistry

After successfully completing this course, students will be able to:

CO1 Explain the chemistry of life.

CO2 Define the basic terminologies of metabolic pathways.

CO3 Explain bioenergetics, concept of free energy and ATP as currency molecule.

CO4 Explain the structure, functions and reactions of the various biomolecules – carbohydrates, lipids, proteins and nucleic acids.

CO5 Classify and give examples of each group type of biomolecules.

CO6 Draw the structures of various carbohydrates, lipids and amino acids.

CO7 Correlate the changes in the levels of these biomolecules with the diseases in human.

CO8 Explain the importance of vitamins and coenzymes and disorders related to them.

CO9 Illustrate the importance of pH, buffer and water in living systems.

CO10 Discuss the oxidation of fatty acids and its significance.

CO11 Illustrate ETC and oxidative phosphorylation.

CO12 Explain purine and pyrimidine metabolism.

CO13 Demonstrate enzyme kinetics.

CO14 Classify enzymes with examples.

CO15 Justify the role of enzymes in metabolism.

CO16 Explain carbon as backbone of biomolecules.

CO17 Analyse the dimensions of the biological samples and study Ramanchandran plots.

Paper XII – Practical – Biochemistry

After successfully completing this course, students will be able to:

CO1 Measure the pH of given samples.

CO2 Prepare acid and base solutions of desired strength.

CO3 Prepare buffers of desired pH.

CO4 Detect carbohydrates, lipids and proteins using biochemical tests.

CO5 Estimate alkaline and acid phosphatases in animal liver tissue.

CO6 Estimate quantity of glycogen, cholesterol and protein in animal tissues.

Paper XIII – Theory – Cell and Molecular Biology

After successfully completing this course, students will be able to:

CO1 Justify the selection of fixatives and stains for histological procedures.

CO2 Explain the procedure of preparing permanent histological slides.

CO3 Explain the location, structure and functions of various cell organelles.

CO4 Diagrammatically represent various cell organelles.

CO5 Describe the composition, structure and functions of the plasma membrane.

CO6 Explain the structure and functions of the nucleus and its components.

CO7 Explain the structure and functions of the mitochondria and its pathways.

CO8 Describe the three primary components of the cell's cytoskeleton and how they affect cell shape, function and movement.

CO9 Illustrate the phases of cell division of somatic and gametic cells and justify their regulation.

CO10 Differentiate between prokaryotic and eukaryotic cell.

CO11 Differentiate between rough and smooth endoplasmic reticulum both in structure and function.

CO12 Illustrate protein trafficking and sorting taking into consideration ER, Golgi body, lysosomes and secretory vesicles.

CO13 Discuss various signal transduction pathways and second messengers.

Paper XIII – Practical – Cell and Molecular Biology

After successfully completing this course, students will be able to:

CO1 Process animal tissues and prepare permanent histological slides.

CO2 Identify the histological peculiarities in various animal tissues.

CO3 Justify the selection of appropriate fixatives and stains for preparing tissue slides.

CO4 Demonstrate mitosis and meiosis from permanent slides.

CO5 Demonstrate basis of reaction at the sites of protein, nucleic acids, lipids and carbohydrates in animal tissue.

CO6 Sketch, label and identify various cells and ultrastructure of cell organelles.

Paper XIV – Theory – Instrumentation and Methodology

After successfully completing this course, students will be able to:

CO1 Explain the importance and applications of techniques in biology.

CO2 Understand optical path length and illustrate the working of microscopes.

CO3 Demonstrate the principle, working and applications of centrifugation.

CO4 Describe the concept of light, electromagnetic spectrum and its application in spectroscopy.

CO5 Compare colorimetric and spectrophotometric methods for protein estimation.

CO6 Explain the principle and applications of various chromatographic techniques with examples.

CO7 Explain the principle, working, materials used and applications of electrophoresis.

CO8 Understand Polymerase Chain Reaction and its modifications (RFLP, RAPD, AFLP, RT-PCR and Real-Time PCR).

CO9 Justify the significance of aseptic experimental conditions in biological cultures.

CO10 Differentiate between monolayer and suspension cultures.

CO11 Grasp the basic idea of leucocyte and organ cultures.

CO12 Illustrate the importance of radioactive isotopes and half-life in biology.

CO13 Describe radiation dosimetry, liquid scintillation counter, tracer techniques, autoradiography and Cerenkov radiation.

CO14 Justify the applications of radioactive compounds in biology.

Paper XIV – Practical – Instrumentation and Methodology

After successfully completing this course, students will be able to:

CO1 Use proper laboratory safety protocols.

CO2 Effectively use microscopes for tissue analysis.

CO3 Clean and maintain the microscopes.

CO4 Study living material under phase contrast microscope.

CO5 Draw figures of structures/organisms using camera lucida.

CO6 Measure the cell/organism's dimensions using stage micrometer and occulometer.

CO7 Demonstrate section cutting and mounting sections on the grid for SEM and TEM.

CO8 Demonstrate working of ultracentrifuge.

CO9 Isolate protein, enzymes and sub-cellular organelles from biological source.

CO10 Amplify DNA using PCR and check its integrity on spectrophotometer.

CO11 Use Western Blotting to isolate proteins of interest.

CO12 Separate samples of amino acids with the help of paper chromatography.

CO13 Separate DNA bands through agarose gel electrophoresis.

CO14 Analyse proteins using native PAGE and SDS-PAGE

Paper XV – Theory – Advances in Entomology

After successfully completing this course, students will be able to:

CO1 Enlist salient features of various insect orders with examples.

CO2 Describe diagrammatically the structure and function of digestive, respiratory, nervous and reproductive systems in insects.

CO3 Explain post-embryonic development and types of metamorphosis in insects.

CO4 Illustrate the structural modifications in larvae and pupae.

CO5 Explain parthenogenesis in insects.

CO6 Define the effect of temperature and photoperiod on the lives of insects.

CO7 Discuss the onset, termination and significance of diapause.

CO8 Understand plant host-insect interactions.

CO9 Explain the practices of sericulture, apiculture and lac culture.

CO10 Illustrate the systematic position, habits, nature of damage and outline the life cycle of pests of cotton, sugarcane, paddy, wheat, vegetables and fruits.

CO11 Illustrate the systematic position, habits, nature of damage and outline the life cycle of pests of stored food grains.

CO12 Classify different categories of insecticides used in chemical control of insects.

CO13 Describe biological methods of pest control.

CO14 Achieve a thorough understanding of Integrated Pest Management.

Paper XV – Practical – Advances in Entomology

After successfully completing this course, students will be able to:

CO1 Study insect biodiversity in natural environment.

CO2 Identify and taxonomically place the insect pests in classification system.

CO3 List the household pests and social insects.

CO4 List the pests of medical and veterinary importance.

CO5 Demonstrate dissection of insects' digestive, nervous and reproductive systems

CO6 Handle beehives in apiaries.

CO7 Explain the tools and techniques used in apiculture, sericulture and lac culture.

CO8 Differentiate between male and female external genitalia of insects.

CO9 Identify different types of larvae and pupae.

M.Sc. Zoology – Second Year – Semester IV

Paper XVI – Theory – Developmental Biology – II

After successfully completing this course, students will be able to:

CO1 Describe the key events in early and systematic embryological development.

CO2 Grasp the concept of organogenesis through vulva formation in *Caenorhabditis elegans* and eye lens induction.

CO3 Differentiate between primary and secondary embryonic induction.

CO4 Explain the chemical nature of evocators.

CO5 Describe stem cells, associated disorders and gene therapy.

CO6 Discuss the concept of metamorphosis.

CO7 Understand the process Teratogenesis and enlist major teratogens.

CO8 Understand the concept of Totipotency.

CO9 Discuss cell surface adhesion, inter-cellular adhesion and adhesive molecules.

CO10 Correlate environmental evolution and animal development focussing on developmental constraints.

CO11 Explain the concept of sex determination.

Paper XVI – Practical – Developmental Biology – II

After successfully completing this course, students will be able to:

CO1 Prepare permanent stained slides of developing stages from fertilized egg of hen.

CO2 Sketch, label and explain the whole mounts and transverse sections of chick embryo.

CO3 Identify different larvae in invertebrates – platyhelminthes, arthropods, molluscs, echinoderms.

Paper XVII – Theory – Advances in Parasitology

After successfully completing this course, students will be able to:

CO1 Define the basic terms in parasitology – parasitism, mutualism and hyperparasitism.

CO2 Understand parasite-host specificity, its types and the factors affecting it.

CO3 Explain molecular, cellular and physiological basis of host-parasite relationship.

CO4 List common ectoparasites and endoparasites.

CO5 Classify parasites into Protozoa, Trematoda, Cestoda and Nematoda.

CO6 Describe immunity to parasites causing malaria, leishmaniasis, trypanosomiasis, schistosomiasis and ascariasis.

CO7 Enlist the common insect vectors of human parasitic infection.

CO8 Justify the control measures of arthropod vectors.

CO9 Illustrate the routes of transmission of parasites.

CO10 Understand circadian rhythm with respect to parasite infection.

CO11 Discuss the ecology of parasites.

CO12 Convince the importance of hygiene with respect to epidemic diseases.

Paper XVII – Practical – Advances in Parasitology

After successfully completing this course, students will be able to:

CO1 Identify protozoan and helminth parasites infecting frog, toad and common household insects.

CO2 Isolate and identify helminth parasites infecting gut of sheep and goat.

CO3 Locate parasites in stained blood smears of humans infected with *Leishmania*, *Plasmodium* and *Trypanosoma*.

CO4 – Identify vectors of different parasitic infections (mosquito, ticks, sandfly).

Paper XVIII – Theory – Advances in Fish and Fisheries

After successfully completing this course, students will be able to:

CO1 Understand history, scope and types of aquaculture.

CO2 Illustrate the preparation and management of fish farming methods – ponds, lens, cages, raceway etc.

CO3 Differentiate between monoculture and polyculture.

CO4 Understand the principle of composite fish culture, its types and significance.

CO5 Enlist the endemic and exotic fishes.

CO6 Observe the influence of limnological parameters in fish populations.

CO7 Describe the tools and techniques for induced breeding.

CO8 Classify ecologically the various aquatic organisms.

CO9 Differentiate between lentic and lotic habitats.

CO10 Justify the concept of productivity and classification of water bodies based on it.

CO11 Discuss the nutritional value of fish.

CO12 Observe post-mortem changes and microbial spoilage in fish.

CO13 Illustrate techniques of fish harvesting and management of fish culture ponds.

CO14 Explain the principles of fish preservation, processing, transportation and marketing.

CO15 Manage biological control of weeds/algal blooms using fish.

CO16 Understand the concept of Transgenic fish and bio-safety regulations.

CO17 Enlist molecular markers used for fish identification.

CO18 Determine age of fish using hard parts.

CO19 Determine growth of fish using length-weight equation.

Paper XVIII – Practical – Advances in Fish and Fisheries

After successfully completing this course, students will be able to:

CO1 Estimate the content of dissolved oxygen and phosphates in water.

CO2 Estimate the pH of water.

CO3 Determine the BOD of water.

CO4 Identify benthic organisms in a water body.

CO5 Compare the different types of fishing gears.

CO6 Enlist the culturable Indian and Exotic fishes.

CO7 Estimate the total alkalinity, hardness and chloride content in water samples.

CO8 Evaluate the bioindicators of pollution in fresh water.

Paper XIX – Theory – Environmental Biology and Wild Life

After successfully completing this course, students will be able to:

CO1 Understand causes, impact and control measures of air, water, land and noise pollution.

CO2 Develop strategies for effective waste management system.

CO3 Understand the importance of wildlife conservation.

CO4 Know about natural resources, renewable and non-renewable, the cause of their depletion and their conservation.

CO5 Understand the goals, objectives and methods of teaching of environmental education.

CO6 Describe the resilience of ecosystem along with its dynamics and management.

CO7 Demarcate zoogeographical realms on world map and categorize the endemic fauna as per the geographical distribution and climate.

CO8 Enlist important National Parks, Sanctuaries and Biosphere Reserves of India.

CO9 Differentiate between *ex situ* and *in situ* conservation strategies of wildlife.

CO10 Explain wildlife management in India and conservation strategies taken by the government.

Paper XIX – Practical – Environmental Biology and Wild Life

After successfully completing this course, students will be able to:

CO1 Demarcate zoogeographical realms on world map and categorize the endemic fauna as per the geographical distribution and climate.

CO2 Visit Zoological Parks and prepare reports on different wild animals.

CO3 Estimate alkalinity, chloride and nitrate content of water.

CO4 Demonstrate different types of phyto- and zooplankton in water.

Paper XX – Theory – Cytogenetics and Molecular Genetics

After successfully completing this course, students will be able to:

CO1 Understand the C-Value Paradox and Law of DNA Constancy.

CO2 Clarify the concept of population genetics through Hardy-Weinberg Law.

CO3 Calculate various gene frequencies in local populations.

CO4 Discuss the linkage groups, crossing over and frequency of recombination.

CO5 Determine the gene order, distance and map from given data of crossing over.

CO6 Discuss genome organization including coding and non-coding sequences.

CO7 Illustrate fine structure of gene including satellite DNA.

CO8 Explain chromosome structure and function.

CO9 Differentiate between euchromatin and heterochromatin.

CO10 Describe polytene and lampbrush chromosomes.

CO11 Justify the concept of Dosage Compensation.

CO12 Explain gene mutation and chromosomal aberrations.

CO13 Understand site-directed and radiation mutagenesis, and target theory.

CO14 Draw the structure of DNA, mRNA, tRNA and rRNA.

CO15 Paraphrase the Central Dogma of Molecular Biology.

CO16 Illustrate the mechanism of replication, transcription and translation.

CO17 Explain mechanism of DNA damage and repair.

CO18 Justify the post-transcriptional and post-translational modifications.

CO19 Describe regulation of gene function and understand operon concept.

CO20 Discuss the tools and techniques used in Genetic Engineering and their applications in agriculture, health and industry.

Paper XX – Practical – Cytogenetics and Molecular Genetics

After successfully completing this course, students will be able to:

CO1 Analyse metaphase karyotypes of man, rat, *Drosophila* and grasshopper.

CO2 Prepare chromosome slides from onion root tip by squash method to demonstrate mitosis.

CO3 Prepare and stain temporary mounting of polytene chromosomes from *Chironomus*/*Drosophila* larvae.

CO4 Justify the effect of colchicine on cell division.

CO5 Prepare temporary mounting of sex chromatin/Barr Body from human buccal mucosa.

CO6 Demonstrate Mendelian laws through monohybrid and dihybrid crosses using beads.

CO7 Illustrate the modified Mendelian laws of inheritance – codominance, incomplete dominance and epistasis.

CO8 Identify genetic disorders based on karyotypes and traits.

CO9 Identify structural alteration of chromosomes and associated diseases.

CO10 Identify numerical alteration of chromosomes and associated diseases.

BBA (BACHELOR OF BUSINESS ADMINISTRATION)

Program Outcomes:

PO1 : An Understanding of Business Functions

PO2 : Providing Global Perspective

PO3 : Developing Critical and Analytical Thinking Abilities

PO4 : Interpersonal Skill Development

PO5 : Creating Social Sensitivity and Understanding Ethical and Sustainable Business Practices

PO6 : Demonstrate sensitivity to social, ethical and sustainability issues

PO7 : Ability to analyze various functional issues affecting the organization

PO8 : Demonstrating ability to evolve strategies for organizational benefits

PO9 : Demonstrate the ability to develop models / frameworks to reflect critically on specific business contexts

PO10 : Develop Ethical Practices and Imbibe Values for Better Corporate Governance.

PO11 : Analyze Global Environment and its Impact on Business

PO12 : Understand the ecosystem of start up in the country and demonstrate the ability to create business plans

Course Outcomes:

BBA101 : History And Culture Of Punjab – I

CO: To introduce the students to the history of the Punjab region

BBA S102 : Business Statistics

CO : To impart the students about the basic knowledge of statistics

BBA S103 : Fundamentals Of Information Technology

CO1 : To provide fundamental knowledge about IT so that student can better perform in any area of operation

CO2 : Can even excel in the field of commerce with IT specialization

BBAS104 : Management Concepts And Practices

CO : To help the students understand the process of business management

BBAS105 : Financial Accounting

CO : Teach basic accounting principles and techniques of preparing and presenting the accounts for user of accounting information.

BBAS106 : Essentials Of Business Economics – I

CO1 : Impart knowledge of basic concepts of micro and macroeconomics relevant for Business decision making

CO2 : Helping them to understand the application of economic principles in business Management

BBA 201: English And Business Communication Skills

CO : Inculcate the basic Business Communication & Writing Skills including business letters, tender notices, auction notices, public notices; memos and advertisements relating to sales/marketing

BBA 202 : Operation Research

CO : Understanding of operations Research and its applications in managerial decisions

BBA 203: Marketing Management

CO : Knowledge of basic concepts, philosophies, process and techniques of marketing

BBA 204: Economics Of Money & Banking

CO : Understanding basic concepts of economics of money and banking

BBA 205: Regulatory Framework For Companies

CO : Impart basic knowledge of the provisions of the Companies Act 2013 with relevant case laws

BBA 206:Direct Tax Laws

CO : Provide basic knowledge of the provisions of direct tax laws in India

BBA 221:English And Business Communication Skills

CO : Improvise Writing Skills on business précis-writing, curriculum vitae & short formal reports and modern Forms of Communication

BBA 222 : Project Management

CO : Enable to acquire basic knowledge of different facets of Project Management

BBA 223 : Research Methodology

CO : To provide knowledge to the students about fundamentals of business research

BBA 224 : Human Resource Management

CO : To familiarize the students with the different aspects of managing human resource in the Organization

BBA-225 : Goods And Service Tax

CO : Understanding of basics of GST

BBA 226 : Database Management System

CO : Basic knowledge of data base management systems

BBA 301:Insurance And Risk Management

CO : The principles and practices followed in the insurance sector; risk management process and Applications

BBA 302 : International Business

CO : To familiarize students with the concepts, importance and dynamics of international business; mechanics of global business operations and development

BBA 303 : Business Environment

CO1 : To acquaint the students with various environmental factors that create a profound impact on the business organization;

CO2 : Analysis and understanding the implications of different macroeconomic policies implemented by the Government.

BBA 304 : Entrepreneurship AndSmall Business Management

CO1 : To familiarize the budding entrepreneurs with the competencies and qualities of successful entrepreneurs

CO2 : To help learners understand various issues involved setting up a private enterprise and develop required entrepreneurial skills in economic development

BBA 305 : Consumer Behaviour

CO1 : The course aims at enabling students to understand the process of consumer behaviour, issues and dimensions, factors that influence consumer behaviour

CO2 : To apply this understanding to the development of marketing strategy

BBA 306 : Sales And DistributionManagement

CO1 : To acquaint the student with the concepts which are helpful in developing a sound sales and distribution policy

CO2 : In organizing and managing sales force and marketing channels

BBA 307 : Financial Markets And Services

CO : To advance the understanding of fundamental concepts of financial markets, financial

instruments in various markets and important financial services

BBA 308 : Investment Management

CO : To advance the understanding of fundamental concepts of security analyses and working knowledge of portfolio management and evaluation

BBA 309 : Social Security & Labour Welfare

CO : Acquaint the students with the two important aspects of Industrial Relations – Social Security and Labour Welfare

BBA 310:Industrial Relations And Labour Legislations

CO : Acquaint the students with the different aspects of Industrial Relations and the relating labour laws

BBA 321 : Business Policy AndStrategy

CO : Insight into the strategic planning process in an organizations

BBA 322 : Production And Operations Management

CO1 : Knowledge regarding production and operation management tools, techniques and processes and familiarize students;

CO2 : Taking managerial decisions with respect to production function

BBA 323: Social And Ethical Issues In Business

CO : Importance of ethics in business and understanding of issues related to corporate social responsibility and corporate governance

BBA 324 : Project Report And Viva Voce

CO : Carrying out short-term projects and report writing followed by evaluation

BBA 325 : Advertising And BrandManagement

CO : An understanding of the basic principles of advertising management & complex constructions in the planning and execution of a successful advertising program;issues and challenges of branding

BBA 326 : Marketing Of Services

CO : Enabling students to apply marketing concepts and principles to the unique challenges and opportunities of services marketing to create customer value

BBA 327 : Cost Analysis And Control

CO : Provide knowledge to the students about the various components of the cost and techniques of cost control

BBA 328 : Accounting For Management

CO : Learning of concepts of cost and management accounting and their application in managerial decision making

BBA 329 : Human Resource Planning And PerformanceManagement

CO : Help the students gain conceptual understanding of Human resource planning and performance management within an organization

BBA 330:Compensation Management

CO : Basics of managing compensation systems of an organization and understand its application

Diploma in Journalism and Mass Communication

Program outcome (PO)

PO1- The program helps student to sharpen their specialization skills in the field of Mass Media.

PO2- The program is designed to create an awareness among the students about mass media research.

PO3-The students will be able to write specialized stories for various media.

PO4- The students will learn to use Public Relation tools like Press release, news etc.

PO5-The students will understand the importance of media survey and media seminars.

PO6- The student will acquaint the knowledge of Research report writing.

Course Outcomes (CO)

Semester – I

Paper – (GEN 101) Communication Skills

CO 1: The course will include communication skills in students so that they can communicate effectively. It will foster teamwork and cultivate success in formal and informal setups.

CO 2: The course also introduces Business Communication which helps the students in the future toknow the business better and creates better relations.

CO 3: The students will get familiar with the concept of verbal and non-verbal communication. In verbal communication, they will get to know the importance of words, their selection, and their tone in different situations. Through the in-depth study of non-verbal communication, they will be able to express their thoughts, emotions, sentiments, and feelings with other people without uttering a single word and get to know the significance of gestures.

CO 4: Through SWOT analysis they can diagnose themselves by strengthening their positive points, knowing their weaknesses will grab new opportunities and eradicate their threats.

CO 5: Report writing in the course will enhance the writing skills of the students.

Paper – (GEN 102) Fundamental of Information Technology

CO 1: The students will be able to install Hardware and software.

CO2: The students will learn about the motherboard, BIOS and storage devices features and its functions.
CO 3: The Students will be able to demonstrate how to organize files and documents on a USB/ hard drive.
CO 4: The students will be able to develop a vocabulary of key terms related to the computer and to software program menus.

Paper – (JMC 01) Reporting and Feature Writing

CO 1: The course is to makes the students understand the meaning of news, feature, articles, beats, types of news and news reporting.
CO 2: This course also describes the concept of news in detail with the classification of softnews and hard news and demonstrates the news writing skills using 5W‟s & 1H.
CO 3: The students can easily analyze the process of news gathering from different sources tothis particular course.
CO 4: The course appraises the different types of News Beats for better employability for the students.

PAPER – (JMC 02) Mass Communication

CO 1: The course describes the purpose, types and process of human communication. It also introduces students to the various concepts, models & theories of mass communication.
CO 2: Communication plays an important role in life. This course discusses the meaning, nature, scope and levels of communication among the students.
CO 3: The students understand in depth about the theories of communication,selected models and processes of communication through this particular course.
CO 4: The students will be able to recognize the difference between traditional mass media, folk media and new media and also examine the relationship between mass media, society and culture

PAPER – (JMC 03) Basics of Computer

CO 1: The main objective of the course is to acquaint the students with fundamental aspects of computer technology and introduce editing software.
CO 2: This course also describes the characteristics, uses and meaning of MS-word MS-Power Point and MS-Excel.
CO 3: In depth knowledge and practice of media production related software will help the students to recall software commands and shortcuts and to develop their thinking about media content production.

Semester - II

PAPER – (GEN 201) Soft Skills and Personality Development

CO 1: The course focuses on the concept of Human Development, through which students willbe able to lay emphasis on the latent resources which every human being posses.
CO 2: The course fulfills the need and importance of creating an awareness of the resources and maximizes the same to enable the students meet the challenges of modern world.
CO 3:Soft skills give each student a realistic perspective of work and work expectations, to help formulate problem solving skills to guide students in making appropriate and responsible decisions.
CO4: Personality Development portion in this course helps to build self- confidence, enhance self- esteem and improve overall personality of the students.
CO 5: The program helps in grooming the students through sensitizing them about proper behavior, socially and professionally in formal and informal circumstances.

PAPER – (JMC 04) Editing

CO 1: The students will understand the News Editing and various processes of editing, online editing and offline editing in various form of media content.
CO2: This course will help the students to develop their editing skills. Editor plays an important role in media industry (Print Media, Electronic Media) and how they use their editing skills.
CO 3: This course also provides the students a deep knowledge about the editorial department of media industry.
CO 4: Headline writing also an art the students can develop the skill of headline writing to this particular course so that they can apply these skills in industry for better employability.

PAPER – (JMC 05) Graphics design

CO 1: This course teaches the students through the various processes that a newspaper goes through between reporting and circulation. The course will alsoteach themto plan specific pages, their layout and design.
CO 2: The course describes the basic principles and elements of design and its usage in production and designing of posters, brochures and magazines.
CO 3: A critical and in depth knowledge of basic elements and principles of design will be developed among the students and they can professionally design in newspaper layout and design.
CO 4: This course is to make the students understand and differentiate design and composition style and identify different publishing techniques and printing methods.

PAPER – (JMC 06) New Media Technology

CO 1: This course intends to expose students to the basic features and functionality of internet, how internet incorporates other forms of media, the concept of convergence and Social implications.
CO 2: The course also involves the applications of the new media excluding the technology and programming skills of any nature so that the students can explore the concepts like digitaldivide and convergence of media.
CO 3: The course helps the students to understand the role of web media as a news media so that they can differentiate between online advertising and traditional advertising.
CO 4: Cyber laws, virtual reality and other online aspects will develop among the students of this particular course so that they can enjoy the real charm of internet.

PAPER – (JMC 07) Electronic Media

CO 1: The students show the ability to understand the meaning, definition, characteristics, advantages and disadvantages of the electronic media.
CO 2: This course acquaints the students with history of radio in India, organizational structure, various departments and news service division of AIR and objectives of broad casting.
CO 3: This course also provides the students with detailed information about the various tiers of radio broadcast and origin and development of television in India as well as formation of Doordarshan.
CO 4: The deep knowledge of Doordarshan‟s organizational structure, functions, different divisions and departments is provided to the students of this particular course.

PAPER – (JMC 08) Industrial Training

The students are taken to various industries to look in to the work ethics of the industries along with getting proper training under the guidance of experts. This further makes them confident for their future prospects