B.Sc. Botany (Hons.)
Course Outcome

CC-1 Microbiology and Phycology

Course Outcome	The students would be able to understand the diverse nature of microbes and their interaction with other organisms; basic nature and impact of viruses; potential of various microbes and the approaches to use them for human welfare; able to identify the important microbes including bacteria, cyanobacteria, and algae available in local environments and understand their economic roles; examine the and manage pathogenic organisms and the method of their control.

CC-2 Biomolecules and Cell Biology

Course Outcome	Students shall understand the importance of energy for cellular processes.
	Students shall have the ability to explain the structures and purposes of basic cellular components, especially macromolecules, membranes, and organelles.
	Students shall apply the knowledge on how these cellular components are used to generate and utilize energy in cells.
	Students shall apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes.
	Students shall have the capacity to explain the mechanism mitotic and meiotic cell division.

CC-3 Mycology and Phytopathology

Course Outcome	The students shall be able to express their understanding on the life cycle of commonly occurring fungal genera and the disease caused by them.
	The students shall be able to explain the types of fungal associations and their importance.
	The students shall have knowledge and skill on the application of fungi and fungal biomolecules in human welfare.
	The students shall be able to explain the host - parasite relationship and its role in establishment of viral, fungal and bacterial diseases in plants.

CC-4 Archegoniate

Course Outcome	The students shall have ability to differentiate the mechanisms of the evolution of the higher plants and their adaptation to land habit.
	The students shall be able to compare the diversity of different archegoniates and their and their pattern of habitat specific distribution.
	The students shall have skill to differentiate the primitive vascular genera on the basis of their morphology and anatomy.
	The students shall ability to identify the members of pteridophytes and knowledge on their characteristic features.
	The students can categorize the unique features and distribution of gymnosperms.

CC-5 Anatomy of Angiosperms

Course Outcome	The students shall be able to explain the internal anatomy of plant systems and organs.
	The students shall develop a critical understanding of the evolution of the concept of organization of shoot and root apex.
	The students shall have the ability to explain the composition of different parts of plants and their relationships.
	The students shall differentiate between the normal and protective morphological systems of plants.
	The students shall be able to differentiate the adaptive and non-adaptive secondary tissues.

CC-6 Economic Botany

Course Outcome	The students can explain the fundamental concepts of Economic Botany and its application in human welfare.
	The students shall be able to explain the origin and evolution of crops and the importance of wild relatives in crop improvement
	The students shall be able to apply their basic knowledge on germplasm and the importance of their conservation.
	The students can explain the cultivation practices of common crops.
	The students can categorize the plants used as a source of food, beverages, spices, and materials.

CC-7 Genetics

Course Outcome	The students shall be able to explain the basic principles of inheritance at the molecular, cellular and organismal levels.

	The students shall have ability to explain the mechanism of inheritance and its relationship with the expression of morphological traits.
	The students shall can establish the relationships between molecule/cell level phenomena (“modern” genetics) and organism-level patterns of heredity (“classical” genetics)
	The students can analyze the variations due polyploidy, chromosomal aberration and gene mutations.
	The students shall understand and explain the functions of linked genes and recombination mapping.

CC-8 Molecular Biology

Course Outcome	The students shall be able to explain the organization and structure and replication of DNA and RNA.
	The students shall be able to differentiate between the organization of prokaryotic and eukaryotic nucleic acids.
	The students shall have a clear understanding on the structure and function of organellar genome.
	The students shall able to explain the processes of bidirectional, semi-conservative and semi discontinuous mode of replication and the importance of the genetic code.
	The students shall be able explain the mechanism of translation in prokaryotes and eukaryotes.

CC-9 Plant Ecology & Phytogeography

Course Outcome	The students shall have ability to differentiate the ecological functioning of ecosystems and would certainly help students to maintain the local ecosystems.
	The students shall have information on species’ geographical range and how the size and life history influenced by the various components of ecosystems.
	The students shall be able to explain the impact of ecological factors on abundance and distribution in populations.
	The students shall have knowledge to analyze the process of soil formation and approaches to study the nature of soils.
	The students shall have skill to evaluate the dynamics of change of population characteristics

CC-10 Plant Systematics

Course Outcome	The students can explain the use various taxonomic literature, Flora and herbaria, keys of both physical and digital types for plant identification and floristic studies.

	The students shall be able to critically analyze the ancient, traditional and modern classification systems and evaluation of their applicability in taxonomic placement of taxa.
	The students shall have ability to explain the evolution of the concepts in classifying plants and weighing the potential of various tools.
	The students shall have ability to build the phylogeny among various taxa of different levels of hierarchy and identifying the apomorphy and plesiomorphy.
	The students can explain the morphology of plant specimen for taxonomic description and identification of the family, genus and species level.

CC-11 Reproductive Biology of Angiosperms

Course Outcome	The students shall have an understanding on the fundamental concepts of Economic Botany.
	The students shall have analyze the evolution of crops/varieties.
	The students shall be aware about the importance of germplasm diversity and learn the methods for their conservation.
	The students shall have ability to explain the diversity of plants and plant products used in everyday life of human and the methods for their enhanced production.

CC-12 Plant Physiology

Course Outcome	The students can explain the governing principles behind the various physiological life processes in plants.
	The students shall be able to explain various uptake and transport processes (water and solutes) in plants and the factors governing these processes.
	The students shall make critical analysis of role of various plant hormones, signaling compounds, and stress responses.
	The students shall have skills to apply the plant hormones in plants for desired morphological and physiological responses.

CC-13 Plant Metabolism

Course Outcome	The students shall be able to explain the importance of biochemical pathways and their regulatory mechanisms.
	The students can explain the signaling pathways and signal reception and delivery mechanisms.
	The students shall have ability to differentiate various carbon fixation pathways and explain their evolutionary significance.

	The students shall have proper level of knowledge on carbon oxidation and energy synthesis.
	The students can explain the processes of lipid metabolism and its importance in the germinating seeds.

CC-14 Plant Biotechnology

Course Outcome	The students shall have knowledge to explain the methods of Plant Tissue culture and its application.
	The students shall be able to describe the Somatic embryogenesis; Embryo culture and embryo rescue
	The students shall have skill to isolate plant Protoplast and differentiate the normal and hybrid protoplasts
	The students shall have knowledge to make the Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries
	The students can describe the methods for developing transgenic plants and application of transgenics for human welfare.

DSE-I Analytical Techniques in Plants Sciences

Course Outcome	The students shall have a proper understanding of the microscopy and knowledge to analyze plant samples using electron microscopy and flow Cytometer.
	The students shall be able to separate biomolecules and cell organelle and appropriate application of the knowledge of centrifugation for the same.
	The students shall be able to make the use of radioisotopes for analysis of biological samples.
	The students can make extraction and qualitative and quantitative analysis of extracts as well as the assay mixtutes using spectrophotometer.
	The students can apply the chromatographic techniques for separation of amino acids, pigments and biomolecules.
	The students shall be able to identify the proper method for characterizing protein and nucleic acids and skill on handling electrophoresis equipment for preparation of gels.

DSE- II Natural Resource Management

Course Outcome	The students shall be able to indicate importance of each component of natural resources and try to use the available resources judiciously.
	The students can describe different biological conventions and treaties emphasizing the conservation of biological diversities.
	The students shall explain the importance of sustainable use of natural resources and procedures for their assessment.
	The students shall have skill to identify the renewable energy sources and actively participate in popularization of the methods of energy and resource conservation.

DSE-III Horticulture Practices & Post Harvest

Course Outcome	The students shall indicate the importance of crop diversification and the contribution of horticulture to nutritional security and economic growth of the country.
	The students shall have ability to classify ornamental, vegetable, fruit and floricultural import plants and their agroclimatic requirements.
	The students shall have skill to identify the pests, pathogens and method of their control in horticultural crop by environment friendly approaches.
	The students can describe the application of various modern methods of plant propagation and improvement of horticultural crops.
DSE-IV Project Work	

Programme Outcome
B.Sc. Botany (Hons.)
Programme Outcomes

The Bachelor of Science degree in Botany focuses on the scientific study of plants, and the understanding of how plants provide aesthetic beauty, as well as materials for basic needs, including food, shelter and oxygen.Botanical research has diverse applications in modern horticulture, agriculture, soil science and forestry, in addition to pharmacology and biotechnology.Many students continue their education in graduate or professional programs. Those opting to enter directly into the workforce find jobs in fields related to the economic importance of plants, including agriculturally-based and related professions, environmental consulting or in federal, state or local agencies. Department of Plant Sciences offer several mechanisms to help students prepare for their future careers.

PO1.Knowledge and understanding:

Students can learn the range of plant diversity in terms of structure, function and environmental relationships. They can evaluate the plant diversity,Plant classification and the flora of Odisha. They can understand the role of plants in the functioning of the global ecosystem.

PO2. Intellectual skills:

Students can think logically and organize tasks into a structured form. They can assimilate knowledge and ideas based on wide reading and through the internet. There can be a transfer of appropriate knowledge and methods from one topic to another within the subject. They can understand the evolving state of knowledge in a rapidly developing field. They can able to construct and test hypothesis. They can plan, conduct and write a report on an independent term project.

PO3.Practical skills:

Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules. 1. Interpreting plant morphology and anatomy. 2. Plant identification. 3. Vegetation analysis techniques. 4. A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry. 5. Analyze data using appropriate statistical methods and computer packages. 6. Plant pathology to be added for sharing of field and lab data abtained.

PO4.Scientific Knowledge:

Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyse any

plant form.

PO5. Problem analysis:

Identify the taxonomic position of plants, formulate the research literature, and analyse non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

PO6. Design/development of solutions:

Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health

PO7. Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.

PO8. Modern tool usage:

Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

PO9. The Botanist and society:

Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

PO10. Environment and sustainability:

Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO11. Ethics:

Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

PO12. Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO13. Communication:
Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO14. Project management and finance:
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO15. Life-long learning:
Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

M.Sc. Botany
Course Outcome

BOT -101	Diversity of Plants-I
Course Outcome	To impart theoretical knowledge on diversity of microorganisms, their life forms, economic importance and various plant diseases caused by them. Students will learn the basics of microbial techniques like isolation, culture and preservation of bacteria, algae and fungi. Students will learn about origin, evolution and reproductive strategies of bryophytes.
BOT -102	Diversity of Plants-II
Course	Students will learn about origin, evolution and reproductive strategies of bryophytes, pteridohytes and gymnosperms as well as their economic importance. Students will have knowledge on basics of paleobotany and palynology along with their applications.

Outcome	
BOT-103	Cell and Molecular Biology of Plants
Course Outcome	The students will be learning about the structure and function of cell wall and plasma membrane, cell organelles such as chloroplast, mitochondria and others. Students will have knowledge on nuclear organization, DNA structure, replication and repair, transcription, translation and protein sorting. Understanding about regulatory mechanism of cell cycle and apoptosis of the students will be enhanced
BOT-104	Plant Biochemistry
Course Outcome	Students will be learning about concepts of reaction kinetics, thermodynamics and their biological applications, fundamentals of biochemistry including metabolism and bioenergetics. Students will gain knowledge on structure and properties of carbohydrate, proteins, lipids and secondary metabolites. Students will learn the basics of enzyme kinetics and regulation of enzyme activity.
BOT-105	Practical on 101 to 104
Course Outcome	Students will gain practical knowledge on microscopic examination microorganisms like bacteria, fungi, and algae. Students will be learning about gametophytic and sporophytic structures of bryophytes, pteridophytes and gymnosperm. Students will be able to isolate and quantify bio-molecule like DNA, RNA, protein, carbohydrate and lipids. Students will be able to identify different stages of cell cycle.
BOT-201	Cytogenetics, Plant Breeding and Biostatistics
Course Outcome	Students will learn about genetic recombination and mapping techniques, karyotype analysis, chromosomal aberrations, DNA damage and repair mechanism. Students will gain knowledge on plant breeding techniques for crop improvement. Students will have basic knowledge on regulation of gene expression, molecular markers and their application. Students will learn about sampling techniques, testing of hypothesis, correlation and regression.

BOT -202	Biotechnology and Genetic Engineering of Plants
Course Outcome	Students will learn about clonal propagation, production of haploids, somaclonal variants, development of somatic hybrids and cybrids for crop improvement. Students will gain knowledge on recombinant DNA technology and Agrobacterium mediated gene transfer for development of transgenic plants. Students will learn techniques like electrophoresis, blotting techniques, spectroscopy, chromatograph, ELISA etc.
BOT -203	Plant Physiology
Course Outcome	Students will learn about mechanism of membrane transport, transport through xylem and phloem, mechanism of photosynthesis, respiration and nitrogen metabolism. Students will gain knowledge on stress physiology, photoreceptors, flowering and senescence in plants.

BOT -204	Plant Anatomy, Ecology and Evolution
Course Outcome	Students will lean the basic cell and tissue organization in plants and its various applications in the field. Students will gain knowledge on habitat, population characteristics, structure and attributes of community, ecological succession, structure and function of ecosystem. Students will learn about theories of evolution and maintenance of gene frequency in population
BOT -205	Practical based on 201 to 204
Course Outcome	Students will gain hand on training on identification of chromosomal aberrations, karyotyping, photosynthetic pigment isolation and quantification, aseptic techniques in clonal propagation, taxonomic identification of flowering plants, chromatographic techniques for separation of compounds and quantitative analysis of plant communities in various ecosystems.
BOT -301	Plant Development, Reproduction and Economic Botany

Course Outcome	Students will learn about plant cell development, differentiation of apical meristems & vascular tissues, flower development and its genetic regulation. Students will gain knowledge on development of fruit, senescence and its regulation, development of male and female gametophyte, pollen-stigma interactions and double fertilization. Students will learn about centre of origin of plants and various economic uses of domesticated and wild plants.
BOT -302	Conservation Biology
Course Outcome	Students will learn about importance of biodiversity and drivers of biodiversity change, convention of biological diversity, IUCN categories of plants, Biodiversity Act and rules, Strategies for resources conservation and management, in situ and ex situcoservation. Students will gain knowledge on various types of IPR and their protection strategies.
BOT -303	Plant Systematics
Course Outcome	Students will learn about ICBN and rules for plant nomenclature, merits and demerits of major system of classification, Taxonomic evidence and range of floral structures of different orders. Students will gain knowledge about origin and evolution of different clades and families of angiosperms.
BOT -304	Plants and Environment
Course Outcome	Students will learn about components of environment, biogeography and biogeographical zones of India, mangroves and their role for environmental protection, phytoremediation and phytomining, methods. Students will gain knowledge on pollution of water, air and soil, remote sensing and its application in plants and environment, plants and pollution control, biomass and bioenergy, aerobiology and pollen allergy.
BOT -305	Advanced practicals

Course Outcome	Students will gain hand on training on Microtome, germination of pollen grains, isolation and Purification DNA, PCR , electrophoresis, commet assay, antimicrobial assay Quantification of protein, carbohydrate, chlorophyll, proline, sugar etc., phytochemical analysis by TLC/ HPTLC, micropropagation and synthetic seed preparation.
BOT-401(A)	Biochemistry and Molecular Biology-I
Course Outcome	Students will be learning about protein conformation, enzyme kinetics, regulation of enzyme activity, regulation of carbohydrate metabolism, oxidation of fatty acids, cell signaling and signal transduction. Students will gain knowledge on immunoglobulins, mechanism of immune response, vaccines and immunological techniques.
BOT-402(A)	Biochemistry and Molecular Biology-II
Course Outcome	Students will be learning about DNA replication, DNA damage, repair and recombination, Prokaryotic and eukaryotic translation, regulation of gene expression in prokaryotes and eukaryotes, gene correction and editing, molecular makers in genome analysis, designing of ribozymes, applications of antisense and ribozyme technologies.
BOT-403	Dissertation
Course Outcome	Students will learn how to design experiments, think critically and write dissertation. The course will be a preliminary training to do research.
BOT-404	Seminar Presentation
Course	Students will acquire the skill of public speaking, content development for presentation and discussion with audience.

Outcome

M.Sc. Botany

Programme Outcome

M.Sc. Botany is a two-year postgraduate programme to impart advanced knowledge on modern biology. Other than providing students with indispensable knowledge, the programme curriculum fosters problem-solving and critical thinking skills that prepare students to take on any challenges. Under this programme the students gain insights into the key research areas of Botany. The programme encompasses a balance of both theoretical and practical sessions which enables the students to apply their learning and develop end results. The programme focuses on career-oriented subjects like Plant Physiology, Plant Biotechnology, Plant tissue culture, Enzyme Technology and Genetics, Plant breeding and Crop improvement etc.

PO1:

After successful completion of the course, a student is able to understand different fields of Botany like systematics, evolution, ecology, physiology, biochemistry, plant interactions with microbes and insects, anatomy, morphology, reproduction, genetics and molecular biology of various life-forms. She/he even has an edge over other students as they will be trained in skill enhancement courses like biofertilizer technology.

PO2:

The student completing the course is able to classify various life forms of plants, design and execute experiments related to basic studies on ecology, physiology, biochemistry, plant interactions with microbes and insects, morphology, anatomy, reproduction, genetics, microbiology, molecular biology, recombinant DNA technology etc.

PO3:
The student completing the course is capable of executing short-term research projects/dissertations using tools and techniques in any of the basic specializations of Botany under supervision.
PO4:
Students will be able to demonstrate and apply the principles of bioprocess engineering in the design, analysis, optimization and simulation of bioprocess operations.
PO5:
Students will be able to gain fundamental knowledge in plant biotechnology and its applications.

PO6:
Students will be able design, conduct experiments, analyze and interpret data for investigating problems in Biochemistry and allied fields.
PO7:
Higher studies (M. Phil, Ph.D.) can be pursued in order to attain research positions. Various examinations such as CSIR-NET, GATE, ICMR and many other opens channels for promising career in research.
PO8:
Students can become Research associates, Junior Production Officer and Technical assistants in Biochemistry, biotechnology, pharmaceutical Companies, biofertilizer industry, aquaculture industries, environmental units, crop production units, food processing industries, national bio-resource development firms.
PO9:
Entrepreneurship ventures such as mushroom cultivation, consultancy, patho-laboratory and training centres can be opened.
PO10:
Some of the major pharmaceutical and drug companies hiring Botany students include Accenture, Dabur, Ranbaxy, Hindustan Lever and Dr Reddy's Labs, food processing industries, beverage, chemical industry and textile industry as well. Besides this, industries also employ biochemist professionals in their marketing divisions to boost up business in sectors where their products would be required.
PO11:
Students will be able to understand the potentials, and impact of biochemical innovations on the environment and

their implementation for finding a sustainable solution to issues pertaining to the environment, health sector, agriculture, etc.

PO12:

Several career opportunities are available for students with a Plant biochemistry background abroad especially in countries like Germany, Australia, Canada, USA and many more where biochemistry is a rapidly developing field.

Department of Chemistry

Dhenkanal Autonomous College

PROGRAMME OUTCOMES (PO)

POs	The student graduating with BSc (Honours) Chemistry Degree will be able to
PO1	**Core competency:** Acquire core competency in the subject of Chemistry and in allied subject areas
PO2	**Disciplinary knowledge and skill:** Demonstrate comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest
PO3	**Skilled communicator:** The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation
PO4	**Critical thinker and problem solver:** The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic chemistry knowledge and concepts.
PO5	**Sense of inquiry**: It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.
PO6	**Team player:** The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.
PO7	**Skilled project manager:** The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation
PO8	**Digitally literate:** The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work
PO9	**Ethical awareness/reasoning:** A graduate student requires to understand and develop ethical awareness/reasoning which the course curriculum adequately provide
PO10	**Lifelong learner:** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO	The student graduating with BSc (Honours) Chemistry Degree will be able to
PSO1	Understand broad and basic knowledge in chemistry in addition to key chemical concepts, principles and theories.
PSO2	Develop ability and skill to acquire expertise over solving both theoretical and applied chemistry problems
PSO3	Provide an environment that ensures cognitive development in a holistic manner.
PSO4	Gain knowledge and skill to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.
PSO5	Understand a complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects.
PSO6	Be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment
PSO7	To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication
PSO8	Enable the graduate for the preparation of national as well as international competitive examinations, especially UGC-CSIR NET, GATE and UPSC Civil Services Examination.

COURSE OBJECTIVES AND COURSE OUTCOMES

CORE PAPER-1 (C-1), INORGANIC CHEMISTRY-I	
Course Objectives	**Course Outcomes**
To Know the discovery of electron, proton and neutron and their characteristics.	**CO1** Students will be able to apply the fundamental principles of measurement, matter, atomic theory, chemical periodicity, chemical bonding, general chemical reactivity and solution chemistry to subsequent courses in science.
To classify elements into s, p, d and f blocks and learn their main characteristics.	**CO2** Students will be able to understand the discovery of electron, proton and neutron and their characteristics.
To understand the periodic law and significance of atomic no and electronic configuration as the basic for periodic classification. To understand the nature electromagnetic radiation and quantum theory.	**CO3** Students will be able to understand the nature electromagnetic radiation and quantum theory.
	CO4 Students will be able to understand the periodic law and significance of atomic no and electronic configuration as the basic for periodic classification.
	CO5 Students will be able to classify elements into s, p, d and f blocks and learn their main characteristics.
CORE PAPER-2 (C-II), PHYSICAL CHEMISTRY-I	
Course Objectives	**Course Outcomes**
To apply gas laws in various real-life situations. To explain the behavior of real and ideal gas.	**CO1** Students will be able to apply the fundamental principles of measurement, matter, atomic theory, chemical periodicity, chemical bonding, general chemical reactivity and solution chemistry to subsequent courses in science.

To differentiate between gaseous state and vapour. To explain the kinetic theory of gases.	**CO2**	Students will be able to apply gas laws in various real-life situations.
Explain the properties of liquids & solids. To describe condition required for liquefaction of gases. To write the expressions for equilibrium constants.	**CO3**	Students will be able to explain the behavior of real and ideal gas.
To study the laws of equilibrium. To understand various types of colloids and its applications.	**CO4**	Students will be able to differentiate between gaseous state and vapour.
	CO5	Students will be able to explain the kinetic theory of gases.

CORE PAPER-3 (C-III), ORGANIC CHEMISTRY-I	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the basic concepts of organic chemistry, stereochemistry & organic reactions.	**CO1** Students are expected to apply their knowledge to solve problems related to electronic displacements, stereochemistry and organic reactions.
	CO2 Students will be able to synthesize simple organic molecules using the studied reactions.
	CO3 Students will be able to identify various functional groups through the studied experiments.
	CO4 Students will be able to understand the bonding involved in carbon and hetero atoms.
	CO5 Students will be able to aromatic nature of organic compounds.
CORE PAPER-4 (C-IV), PHYSICAL CHEMISTRY-II	
Course Objectives	**Course Outcomes**
	CO2 Students will gain an understanding of the relationship between microscopic properties of molecules with macroscopic thermodynamic observables.
	CO3 Students will gain an understanding of the use of simple models for predictive understanding of physical phenomena associated to chemical thermodynamics.
	CO4 Students will gain an understanding of the limitations and uses of models for the solution of applied problems involving chemical thermodynamic.
	CO5 Students learn depth concepts about thermodynamic systems.

CORE PAPER-5 (C-V), INORGANIC CHEMISTRY-II	
Course Objectives	**Course Outcomes**
To introduce general principles of metallurgy. To apply concepts of acids and bases	**CO1** Students will be able to gain an idea about general principles of metallurgy, acid-base concepts.
To study chemistry of s and p block elements, noble gases and inorganic polymers	**CO2** Students will be able to gain a thorough knowledge about the s and p Block Elements
	CO3 Students will be able to predict structure of noble gas compounds and their reactivity.
	CO4 Students will be able to gain a firm idea about silicones and siloxanes, Borazines, silicates and phosphazenes.
	CO5 Students will be able to apply concepts of acids and bases
CORE PAPER-6 (C-VI), ORGANIC CHEMISTRY-II	
Course Objectives	**Course Outcomes**
To introduce different types of reaction mechanism. To understand the role of solvent, and other parameters upon reaction mechanism.	**CO1** Students will be able to understand the reaction mechanism of an organic transformations.
To introduce with organometallic reagents. To learn the factors which affect acidity of alcohols and phenols.	**CO2** Students will be able to understand the role of solvent, and other parameters upon reaction mechanism.
To gain knowledge about reducing agents and function.	**CO3** Students will get an idea of functional group interconversion and synthesis of smallmolecules using the studied reactions.
To get an idea of preparation and reactivity of acids and acid derivatives	**CO4** Students will gain knowledge about reducing agents and function.
	CO5 Students will get firm idea on the reactivity of carbonyl compounds and acid derivatives.

CORE PAPER-7 (C-VII), PHYSICAL CHEMISTRY-III	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the fundamental aspects of phase equilibrium in binary and three component systems, a knowledge of chemical kinetics and surface chemistry.	**CO1** Students will gain an idea about micelles, CST, Nernst distribution law and azeotropic systems.
	CO2 Students will gain a thorough knowledge of chemical kinetics including Arrhenius equation, collision theory, rate expression of chemical reactions.
	CO3 Students will gain a firm idea about catalysis, mechanisms of catalysis, enzyme catalysed reactions.
	CO4 Students will learn about surface chemistry, various types of adsorption isotherms, chemisorption and physisorption.
	CO5 Students will gain knowledge on phase equilibrium in binary and three component systems.
CORE PAPER-8 (C-VIII), INORGANIC CHEMISTRY-III	
Course Objectives	**Course Outcomes**
To study fundamentals of transition chemistry	**CO1** Students will gain a thorough knowledge of d- block elements, their properties and uses.
To study about the physicochemical properties of d-block and f-block elements	**CO2** Students will gain a firm idea about lanthanides and actinides, their extraction, properties and uses.
To study the basic principles of bioinorganic chemistry	**CO3** Students will learn about the importance of metals ions in biological systems, their functions and toxicological effects.
	CO4 Students will know the basic principles of bioinorganic chemistry.
	CO5 Students will understand the application of molecular spectroscopy to different molecules.

CORE PAPER-9 (C-IX), ORGANIC CHEMISTRY-III	
Course Objectives	**Course Outcomes**
To introduce the factors which affect the basicity of amines, their classification and different chemical properties	**CO1** Students will understand the distinction between different classes of amines and their chemical nature.
To learn the chemical synthesis of polynuclear aromatic ring as well as heterocyclic rings.	**CO2** Students will able to synthesize small rings by using certain reaction.
To get an idea of natural sources of alkaloids and terpenes and their chemical properties	**CO3** Students will get an overall idea of functional group inter conversion of nitrogen containing molecules.
	CO4 Students will learn the structure determination and medicinal importance of certain alkaloid like nicotin, quinine, morphin etc
	CO5 Students will get an idea of natural sources of alkaloids and terpenes and their chemical properties.
CORE PAPER-10 (C-X) PHYSICAL CHEMISTRY-IV	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the basic concepts of conductance and its measurement and an introduction to fundamentals of electrochemistry.	**CO1** Students will gain an idea about conductance and conductivity, derivation of various laws of conductance.
	CO2 Students will gain a thorough knowledge of ionic velocities, hydrolysis of salts.
	CO3 Students Will gain a firm idea about Faraday's Laws of electrolysis, applications in metallurgy.
	CO4 Students will describe various types of electrodes, and the electrical properties of atoms and molecules.
	CO5 Students will describe fundamentals of electrochemistry.

CORE PAPER-11 (C-XI), ORGANIC CHEMISTRY-IV	
Course Objectives	**Course Outcomes**
To focus on structure determination of organic molecules using spectroscopic method such as ultra violet (UV), infrared (IR), nuclear magnetic resonance (NMR) and mass spectroscopy (MS). Also, this course covers one of the important classes of biomolecule i.e., carbohydrates.	**CO1** Students will elucidate the structure and molecular mass of small organic molecules using UV, IR, NMR, MS.
	CO2 Students will able to calculate the absorption maxima of conjugated molecules using Woodward rule.
	CO3 Students will able to gain firm idea of functional groups present in a molecule from IR spectroscopic idea.
	CO4 Students will able to determine the absolute configuration, structure, and constitution, ring size of different mono and disaccharides.
	CO5 Students will able to gain firm idea of biomolecules.
CORE PAPER-12 (C-XII), PHYSICAL CHEMISTRY-V	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the fundamental aspects of quantum chemistry and molecular spectroscopy	**CO1** Students will gain an idea about fundamentals of quantum chemistry including Schrodinger equation and rigid rotator system.
	CO2 Students will gain a thorough knowledge of quantum mechanical treatment of various molecules.
	CO3 Students will gain a firm idea about rotational spectroscopy and vibrational spectroscopy.
	CO4 Students will learn about photochemistry including photoluminescence and chemiluminescence.
	CO5 Students will learn molecular spectroscopy.

CORE PAPER XIII (C-XIII), INORGANIC CHEMISTRY-IV	
Course Objectives	**Course Outcomes**
To introduce students with organometallic compounds, their synthesis, properties and the mechanisms underlying their reaction	**CO1** Students will able to understand various bonding in organometallic compounds.
	CO2 Students will able to understand the preparation and application of ferrocene and other compounds.
	CO3 Students will able to study the theoretical principles in mechanisms of organometallic compounds.
	CO4 Students will able to study thermodynamic & kinetic aspects and reaction mechanism of metal complexes.
	CO5 Students will understand the theoretical principles in qualitative analysis.
CORE PAPER XIV (C-XIV), ORGANIC CHEMISTRY-V	
Course Objectives	**Course Outcomes**
To introduce the students to biomolecules like amino acids, peptides, proteins, enzymes, nucleic acids, lipids, and certain pharmaceutical important compounds and dyes.	**CO1** Students will able to understand the biological role and significance of important biomolecules.
	CO2 Students will gain an insight into classification and molecular features of drug and drug like molecules.
	CO3 Students will able to know about the synthesis and application of natural and synthetic dyes.
	CO4 Students will gain idea about structural and chemical significance of lipids, nucleic acid and dyes and their application.
	CO5 Students will study the therapeutic use of antipyretics, analgesics, anti-malarial and synthesis of certain drug molecules.

Discipline Specific Elective Paper-1 (DSE-I), POLYMER CHEMISTRY	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the fundamental aspects of polymers, their synthesis, their properties and their uses in various commercial sectors.	**CO1** Students will gain an idea about polymeric systems, their classifications, the naming and their properties.
	CO2 Students will gain a thorough knowledge of various synthetic methods for polymers.
	CO3 Students will gain a firm idea about glass transition, crystallinity and morphology of polymers.
	CO4 Students will learn about the preparation, properties and commercial uses of polymers such as PVA, PVC, Teflon etc
	CO5 Students will learn to use the polymers.
Discipline Specific Elective Paper-II (DSE-II), GREEN CHEMISTRY	
Course Objectives	**Course Outcomes**
To introduce students with green chemistry and basic principles of green synthesis and advantages of green synthesis over traditional methods.	**CO1** Students will get an insight into green solvents, safer reagents, and methods to design green methods.
	CO2 Students will understand the advantages of green chemistry over traditional synthesis.
	CO3 Students will able to use and apply natural feedstock and sustainable energy source like solar energy, microwave, ultrasound, mechanochemical energy etc
	CO4 Students will able to design green method by replacing the hazardous, toxic, heavy metal- based reagents and organic solvents with environment friendly reagents and green solvents
	CO5 Students will get an idea of renewable natural feedstock of chemicals and sustainable energy sources.

DSE-III: INDUSTRIAL CHEMICALS AND ENVIRONMENT	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the industrially important gases and chemicals, pollution, ecosystems, energy and environment.	**CO1** Students will able to understand various industrial processes in handling industrial gases and chemicals.
	CO2 Students will gain sound knowledge about ecosystem and pollution.
	CO3 Students will gain an insight into various energy sources and its management and biocatalytic systems.
	CO4 Students will gain sound knowledge about water pollution and water purification.
	CO5 Students will gain sound knowledge about biocatalysis.
DSE-IV: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the industrially important inorganic materials like glass, ceramics, cements etc. and also about fertilizers, batteries, alloys and chemical explosives.	**CO1** Students will able to understand various industrial processes towards manufacture of different types of glasses, ceramics cements, fertilizers, batteries.
	CO2 Students will able to develop complementary skills in designing small industrial setups.
	CO3 Students will get to know about the use of fertilizers and ceramics.
	CO4 Students will get an idea on surface coating and alloys.
	CO5 Students will study about chemical explosives.

GE-I: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the basic concepts of atomic structure, general organic and inorganic chemistry	**CO1** Students will perform calculations with Fajan's rules, Born equation, Slater's rules.
	CO2 Students will understand the organization of atoms and molecules.
	CO3 Students will predict the shapes and geometries of molecules.
	CO4 Students will synthesize different organic compounds with functional group attachment and analysis.
	CO5 Students will able to study the preparation and properties of different organic compounds.
GE-II: CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the basic concepts of various states of matter and equilibrium	**CO1** Students will able to perform calculations with ideal and real gases; predict chemical equilibrium and spontaneity of reactions by using thermodynamic principles.
	CO2 Students will able to apply the concepts of colloids and gels.
	CO3 Students will able to learn depth knowledge about solid & liquid states.
	CO4 Students will able to synthesize alkyl halides, aryl halides, alcohols, phenols etc
	CO5 Students will able to study basic concepts of organic chemistry of compounds containing carboxylic acid, ether, esters etc

GE-III: CHEMISTRY OF S- AND P-BLOCK ELEMENTS, STATES OFMATTER & CHEMICAL KINETICS	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the basic concepts of metallurgy, acid base concepts, s and p block elements and noble gases.	**CO1** Students will gain an idea about general principles of metallurgy, acid-base concepts.
	CO2 Students will gain a thorough knowledge about the s and p Block Elements.
	CO3 Students will able to design experiment to measure the rate of a reaction.
	CO4 Students will able to measure viscosity and surface tension of a liquid.
	CO5 Students will able to study the concept of solids state chemistry.
GE-IV: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY	
Course Objectives	**Course Outcomes**
To introduce the undergraduates about the basic concepts of metallurgy, acid base concepts, s and p block elements and noble gases.	**CO1** Students will gain an idea about s and p-block elements, their properties and uses.
	CO2 Students will gain a thorough knowledge of noble gases and their uses.
	CO3 Students will able to study surface tension of liquids.
	CO4 Students will able to study chemistry of s and p block elements, noble gases and inorganic polymers.
	CO5 Students will able to introduce general principles of metallurgy.

DEPARTMENT OF COMMERCE DHENKANAL AUTONOMOUS COLLEGE

PROGRAMMEOUTCOMES(PO)FORB.COM.

PO No.	**UponcompletionofB.Com.Degreeprogramme,thegraduateswill beableto:**

PO1	Acquiretheessentialknowledgeonthesuccessfulprospectsofbusiness.
PO2	Understandthepracticalissuesandchallengesthatthetradeworld encounters.
PO3	Applyconcepts,principlesandproceduresintransactingbusiness effectively.
PO4	Gainanalyticalskillinundertakingcommercialventuresandevaluate the pros and cons of embarking on trade and trade related activitiesbased on their in-depth knowledge.
PO5	PursueCA,CMA,ACS,CFA,M.Com.,MBAandothercareeroriented programmes.
PO6	Beemployable,exhibitentrepreneurialdriveandbeamodelof principledandethicallysoundbusinessprofessionals.

PROGRAMMESPECIFICOUTCOMES(PSO)FORB.COM.

PSO No.	**UponcompletionofB.Com.Degreeprogramme,thegraduateswill beableto:**
PSO1	Understand the concepts, principles and practices involvedin undertaking business ventures.
PSO2	Developfinancial,cost,auditing,entrepreneurial,marketingand managerial skills.
PSO3	Understandthelegalguidelinesrelatingtothebusinessactivities.
PSO4	GainexpertiseandexhibitprofessionalisminBusinessAccounting, Income Tax assessment and GST calculations.
PSO5	AcquireandapplyICTskillsinbusinessoperations.
PSO6	Be an expert in business correspondence and effective in communication.

PSO7	LearnersventureintoManagerialpositions,Accountingareas,Banking Sectors,Auditing,Company Secretaryship, Teaching,Professor, Stock Agents,GovernmentEmploymentetc.

COURSE OBJECTIVES AND COURSE OUTCOMESOFUG COMMERCE

CORE-1FINANCIALACCOUNTING	
CourseObjectives	**CourseOutcomes**
Understandingaccountingrulesandterminologyand how these are applied to construct financial statements.	**CO1** Understandthetheoreticalframeworkofaccountingand preparationoffinancialstatement.
Understandingtheconceptsandconvergenceof IndianAccountingStandardsandIFRS. Acquiredthe knowledge of developments in accounting.	**CO2** Describe how basic business economic events affect accounts and financial statements
Buildinganawarenessofthejudgmentinvolvedand the discretion allowed in choosing accounting methods, making estimates, and disclosing informationinfinancialstatements.	**CO3** Interpretandanalyzefinancialstatementstoassistin takingvariouseconomic decision.
Togiveknowledgeaboutthepracticalapplicationof variousaccountingtheoriesthroughthehelpof various accounting software.	**CO4** Learnaccounting for hire purchasetransactions, lease, branches and departments.
	CO5 Understand theconcepts ofpartnership firmand prepare the accounts of dissolution of a partnership
	CO6 Develop the skills of preparation of trading profit and loss accounts and balance sheet.
CORE-2BUSINESSLAW	
CourseObjectives	**CourseOutcomes**
The objective of the course is to impart basic knowledge of the important business laws along with relevant case studies.	**CO1** Understand basic aspects of contracts for making the agreements, contracts and subsequently enter valid business proposition.
Topreparefuturepractitionersofprofessional coursesbyimpartingfundamentalknowledgeof businesslaws.	**CO2** The students will have fundamental understandings of differentbusinesscomplicaciesrelatedtobusinesslaws.
To make students abreast of the latestamendments in various business laws.	**CO3** Equipthestudentsaboutthelegitimaterightsand obligations under the sale of Goods Act.
To give hands on knowledge regarding evolving world of business and new enactments in this domain.	**CO4** Rememberingthefundamentalsofinternet based activities under the Information Technology Act

CORE-3COSTACCOUNTING	
CourseObjectives	**CourseOutcomes**
Tomakethestudenttounderstandtheconceptof cost	**CO1** Explaintheconceptofcost,installationofcostingsystem, methods of costing techniques of costing and classificationof cost.
Tomakethestudenttounderstandtheconceptof material	**CO2** Describingtheaccountingandcontrolofmaterial, inventorycontrolandtechniques,pricingandmethods. Labourhour,termsusedinEngineeringandWorkstudy departments,remunerationtoworkersanddifferent bonusplan

Tomakethestudenttounderstandtheconceptof labour	**CO3** Tounderstandthe conceptofOverheadcalculation of machinehourrate,underabsorptionandoverabsorption of overhead
Tomakethestudenttounderstandtheconceptof Overheads its allocation and apportionments	**CO4** Abletojustifytheconceptofjobcosting,contract costing,preparationofcontractaccountandprocess costing, Activity based costing, need and importance, terms used in ABC.
Tomakethestudenttounderstandtheconceptof cost	**CO5** Compareandcontrastcostaccountingbookkeeping systemandreconciliationofcostandfinancialaccount profits.

CORE-4CORPORATELAW	
CourseObjectives	**CourseOutcomes**
Theobjectiveofthecourseistoimpartbasic knowledgeoftheprovisionsoftheCompaniesAct, 2013 and the Depositories Act, 1996.	**CO1** Abletoanalyzethelegalframeworkandthewaysand meanstodealwiththe legalaspectofdifferent situations of corporate sector.
To give overall knowledge about formation, registration of new companies.	**CO2** Able to understand the regulatory aspects and that the boarderproceduralaspectinvolved indifferenttypesof companies covering the Companies Act 2013 and rules there under..
To give knowledge about the reconstruction, liquidation of companies.	**CO3** The students will be able toget knowledge about the reconstruction, liquidation of companies.
To make the students learn about the internal affairs of the company.	**CO4** Equipthestudentswithframeworkofdividenddistribution and role of auditor in a company
	CO5 Comprehend and evaluate working of depositories and their function in stock market.

CORE-5CORPORATEACCOUNTING	
CourseObjectives	**CourseOutcomes**
To make the student to understand the concept of Joint stock company and preparation of the financial statements as per Schedule III of the Companies Act2013withintheframe workofInd AS	**CO1** Develop an understanding of accounts for share capital and debenture.
Tohelpthestudentsunderstand theneed, procedure, accounting effects and treatment for Profit Prior to Incorporation of a Company	**CO2** Describe the preparation of financial statement of Companies under the Companies Act,2013.
Tomakethestudentabletounderstandthe processforissueofsharesanddebenturesand also its redemption.	**CO3** Understand theconceptof mergerand acquisitionandaccounting foramalgamation and external reconstruction
Construct theRestructuringof capital structure in the financial statementof Joint stock company ltd.	**CO4** Compare and contrast the effects of amalgamation and reconstruction of company form of business
	CO5 Evaluating the provision of Companies Act 2013 inpreparationofCorporatefinancialstatement and applying the knowledge for equities and bondtransactions.

CORE-6INCOMETAX&LAW	
CourseObjectives	**CourseOutcomes**

Themainobjectiveofthiscourseistoprovide the basicknowledgeand provisionsoftaxationof income in India as per the Income tax Act 1961.	CO1	Student will able to acquire the basic knowledgeandprovisionsoftaxationofincomeinIn diaasperttheIncometaxAct1961.
Itprovidesopportunitytostudentstogethands on experience of application of principles and provisions of Income Tax Act, 1961.	CO2	Applyingandunderstandingtheapplicationof principles and provisions of Income Tax Act, 1961.
It helps to compute the tax liabilities of different assesses having income from different sources.	CO3	Compute income under the headof'profits and gains of business or profession' Capital gains and'incomefromothersources'thetax liabilitiesofdifferent assesses havingincome from different sources.
It enablesstudentstomaketaxplanningand management by applying tax provisions	CO4	Itenablesstudentstomaketaxplanningand management by applying tax provisions.
	CO5	Widentheabilitytofileonlinereturnof income.

CORE7MANAGEMENTPRINCIPLE&APPLICATION		
CourseObjectives	**CourseOutcomes**	
Toexplaintheevolutionofmanagementandits principles.	CO1	Understand theevolutionofmanagementand apprehend its effect on future managers
To discuss the functions of management and their importance in the business.	CO2	Understand the effective application of different principlesandit'susetodiagnoseandsolve organizationalproblems
Tostudythesystemandprocessofeffective controlling in the Organization.	CO3	Analyzehoworganizationadapttoanuncertain environment and decipher decisionmaking techniquesmanagersusetoinfluenceand control the internal environment.
To analyze and understand the different components of environment and its impact on the Organization.	CO4	Understandthecomplexitiesassociatedwith management of human resources in the organizations and techniquesto handle these complexities.
	CO5	Examine the relationship amongst functions of managementi.e.Planning,organizing,directing and controlling.
CORE8GST&INDIRECTTAX		
CourseObjectives	**CourseOutcomes**	
The objective is to equip students with the principles and provisions of Goods andServices Tax (GST).	CO1	Attachwiththegenesisofgoodsandservicestax (GST),decipherthecon stitutionalamendment carried out to install GST in India and comprehendthecompositionandworkingof GSTcouncil.

To acquaint students with basic provisions of GST Law and basic working knowledge.	CO2	AppreciatethemeaningofsupplyunderGST law,differentiatebetweenintra-stateandinter-statesupply,comprehendrulesrelatedtothe placeofsupplyandcomputethevalueof supply.
Itprovidesopportunitytostudentstogethands onexperience ofapplicationofprinciplesand provisionsofCGSTAct, 2017.	CO3	It provides opportunity to students to get hands on experience of application of principles and provisionsofCGSTAct,2017.
It helpstoknowthetaxliabilitiesofdifferent goods and serviceshaving different tax rates	CO4	Ithelpstoknowthetaxliabilitiesofdifferent goods and services having different tax rates.

	CO5	Understand the provisions for registration under GST along with special provisions such as those related to anti-profiteering; avoidance of dual control;e-waybillsandpenalties.

CORE9FUNDAMENTALOFDATAMANAGEMENT		
CourseObjectives	**CourseOutcomes**	
Togivesomehands-onknowledgetothestudents about fundamental theories and practical implication of computer.	CO1	AbletoknowthebasicconceptsofDBMSlike data independence and three schema architecture
Toteachthestudentsaboutbasictheoriesof WORD, EXCEL and its practical application.	CO2	Thelearnerswillbeabletoknowthepractical usesofwordprocessingandExcelSoftwarein day-to-day business environment
Togivesometheoreticalandpractical knowledgeto the learners about preparation and presentation of business data through Power Point	CO3	Thelearnerswillhavesomehand-onknowledge about Data Base Management System in the various fields like Accounting, HRM etc.
To give some overall ideas about DBMS in the field of Accounting, HRM, Inventory etc.	CO4	Thelearnerswillhavesomeideaabout designingofBusinesswebsitesthroughandits maintenance.
	CO5	Identify the basics of query evaluation techniquesandqueryoptimizationandalsoto getaclearpictureabouttransactionprocessing.
CORE10MANAGEMENTACCOUNTING		
CourseObjectives	**CourseOutcomes**	
To make the student to understand the managerial aspect of accounting information	CO1	Understand thoroughly the conceptual framework of management accounting: identification of differences between different form of accounting – Financial, cost and Managerial; distinction between cost control andcostreduction
To understand thepreparation, presentationand interpretation of various Financial statements.	CO2	Recognizeaboutdifferentmethodsofanalysis andapplicationofmarginalcosting.and decision-makingtechniques
Tounderstand about different methods of analysis andapplicationofmarginalcostinganddecisionis makingtechniques.	CO3	GetholdofknowledgeaboutcashflowfromOperating, investing and financial activities.

Buildingtheawarenessaboutvarianceanalysis, budgetarycontrolanditsmanagerial applications	CO4	Understandingthepreparationofvarious business organization budgets and budgetary control
	CO5	Comprehendtheconceptofrelevantand irrelevantcostsandmakedecisionsrelatedto differentbusinesssituationsusingmarginaland differential techniques.

CORE-11COMPUTERIZEDACCOUNTING&E-FILINGOFTAXRETURNS		
CourseObjectives	**CourseOutcomes**	
Themainobjectiveofthiscourseistoacquaint thestudentswithbasictoolsandtechniquesof Computerized accounting.	CO1	Knowthedifferencebetweene-filingandregular filingofincometaxreturnsandunderstandthe circumstances when e-filing is mandatory.
To provide the working idea of E-Filling provisions and other online tax utilities provided by the income tax department.	CO2	Recognizethebasicprocessofcomputingtaxable income and tax liability, and know about various types of income tax return forms.
To provide in-depth idea of maintaining accountingandtaxationrecordsusingTallyprime software.	CO3	To provide in-depth idea of maintaining accountingandtaxationrecordsusingTallyprime software.
To provide in-depth idea of maintaining accountingandtaxationrecordsusingDBMS software	CO4	ConstructastructureofComputerizedaccounting system for a business firm.
	CO5	Create necessary Tax Adjustments while recording business transactions and generate variousreportsforanalysisanddecisionmaking.
	CO6	Performverificationandauditactivitiesforthe voucher entries passed in computerized accountingenvironment.
CORE-12FUNDAMENTALOFFINANCIALMANAGEMENT		
CourseObjectives	**CourseOutcomes**	
Thebasicobjectiveofthiscourseistofamiliarize the students with the principles and practices of financial management.	CO1	Explainthenatureandscopeoffinancial management aswellastimevaleofmoney. and risk return trade off.
Toimpart knowledgetothestudents for taking decisionsregardinginvestmentinthecapital goodsofthe company.	CO2	Examine capital budgeting process and techniques.
To familiarize the students in making various financial decisions like capital budgeting, dividenddecisionsetc.	CO3	Abletotake variousfinancialdecisionslike capital budgeting, dividend decisions etc.
To give some hands-on knowledge to thelearners about the management of working capital in the business.	CO4	Impart some hands-on knowledge to the learners about the management of working capital of the business.

	CO5	Criticallyexaminevarioustheoriesofdividend andfactorsaffectingdividendpolicy,working capitalmanagement.

CORE-13AUDITINGANDCORPORATEGOVERNANCE		
CourseObjectives	**CourseOutcomes**	
Toprovideknowledgeofauditingprinciples,procedures andtechniquesinaccordancewith currentlegalrequirementsandprofessional standards	CO1	Assess different aspects of auditing especially for internal check, internal control and for overall corporate governance.
Togive an overview of theprinciples of Corporate Governance and its practical implications	CO2	Recognizetheconceptofcorporategovernance in organizationsandits essence formanagement.
TogivesomeoverallideasaboutCorporateSocial Responsibilities of the Companies.	CO3	Make available and assimilate information leadingtofailureoforganizationandcorporate scams.
ToknowsomespecialareasofAuditinthebusiness organizations.	CO4	Understandthegovernanceframeworkforan organizationprovidedbydifferentregulatory bodies in India and Abroad.
	CO5	Distinguishtheessenceofethicsinbusiness.

CORE14BUSINESSMATHEMATICS		
CourseObjectives	**CourseOutcomes**	
To familiarize the students with the basic mathematical tools with emphasis on applications to business and economic situations.	CO1	Realizethebasicconceptsofsystematic processingandinterpretingtheinformationin quantitative terms toarriveat an optimum solution to business problems.
To give some hands-on knowledge to the learners about the implication of mathematics in finance through various tools and Formulas.	CO2	Expand proficiency in using different mathematical tools (matrices, determinants, calculus, linearprogramming, andmathematics offinance)insolvingdailylifeproblems.
To familiarize the students with some business-related decisions by using LPP model and its practical application through use of EXCEL Spreadsheetandothermathematicaltools.	CO3	Be able to solve the practical businessproblems through the use of EXCEL and other mathematical software.
Togivesomehands-onknowledgeregardingsome useful mathematical theorieslikeconcept of Limit and Continuity of a function, Integration etc.	CO4	Synthesize critical thinking and problem solving attitude.
	CO5	Determinetheroleplayedbymathematicsin the world of business and economy.

DSE-I:FINANCIALMARKETINSTITUTIONS&SERVICES(GROUP-A)		
CourseObjectives	**CourseOutcomes**	
To enablethe studentstounderstandthe financial institutionsoperatinginIndiaandservicesprovidedby them.	CO1	Understandthemeaningandscopeoffinancial management as well as institutions in India.

Togivesomeknowledgeregardingtheoverall financialsystemofour Nationanditscontrolling authority.	**CO2** Acquireknowledgeregardingthe variousBanking andNon-BankingFinancial institutionsandits operational activities in the country.
Togivesomeknowledgeregardingthevarious Banking and Non-BankingFinancial institutions and its operational activities in the country.	**CO3** Understandtheconceptofmoneymarketand capitalmarket
To give some hands-on knowledge to the students regarding the role and power of SEBI, RBI in both primary and secondary financial markets	**CO4** Identify the roles, duties and powers of some regulatory authorities like SEBI, RBI in the financial markets
	CO5 ExplaintheconceptofNon-BankingFinancial companies(NBFCs)
	CO6 Develop conceptualclarityaboutthefinancial ServiceIndustry.

DSE-IIFINANACIALSTATEMENTANALYSIS&REPORTING(GROUP-A-ACCOUNTING&FINANCE)	
CourseObjectives	**CourseOutcomes**
Describeandexplaintheobjectivesoffinancial statement analysis.	**CO1** Read,understand,interpretandanalysegeneral purposefinancialreports;
Describethesourcesofinformationforfinancial statement analysis. Calculate and explain	**CO2** Understanddifferingaccountingpoliciesandtheir impact on financial statements;
changesinfinancialstatementsusinghorizontal analysis, vertical analysis, and trend analysis.	
Perform ratio analysis on financial statements usingliquidityratios,long-termsolvencyratios, profitability tests, and market tests.	**CO3** Evaluate different types of performance measurementsystemsinaccountingandcommonly used financial control systems;
Describetheconsiderationsusedinfinancial statement analysis.	**CO4** Makesoundfinancialdecisionsinrealworld settings.

DSE-IIIFUNDAMENTALSOFCORPORATETAXPLANNING(GROUP-A- ACCOUNTING & FINANCE)	
CourseObjectives	**CourseOutcomes**
Toprovideaconceptualideaaboutthevarious provisionsoftaxplanningrelatedtocorporate sector.	**CO1** Understand the concept of corporate tax planning concepts and understand the procedureofassessmentofcorporateassesses.

To impart knowledge about residential status of companies	CO2	Demonstratecriticalthinkingandproblemsolvingskills related to minimization of tax liability of businessentities.
Toimpartknowledgeaboutvariousprovisions relatingtocarryforwardandsetoffof losses	CO3	Understandthespecifictaxissuesforstart-ups, andcomprehendtheIncomeTaxprovisions relevantforfinancialmanagementdecisions.
To be proficient in various provisions relating to capital gain and scientific research	CO4	Understand the utility of Indexation technique to reduce capital gains tax and learn about specific exemptions available from capital gains
	CO5	IdentifytherelevantTaxprovisionsforNon-resident Indians and to understand how to claim reliefincaseofdoubletaxationofincome.
	CO6	Comprehendtaxplanningwithreferenceto businessrestructuring

DSE-IVBUSINESSRESEARCHMETHOD&PROJECTWORK		
CourseObjectives	**CourseOutcomes**	
This course aims at providing the general understanding of business research	CO1	Comprehend the meaning and scope of Business research.
Toimpartsomeknowledgetothestudentsabout the various methods of business research.	CO2	Acquire an insight into various scaling techniques and sources of collection of data.
Toimpartsomeknowledgetothelearnersabout howtocollectdatabyapplyingthevariousmethods ofdatacollection.	CO3	Beacquainted with various techniques of data analysis and its implications
To make the students learn about the various tools and techniques of analyzing and interpreting the data and to give solutions of the research problems	CO4	Gain knowledge about the various steps involved for the preparation of research projects by taking into account the realresearch problem.
	CO5	Learnabout thevarioustools andtechniques of analyzingandinterpretingthedataandtogive solutionsoftheresearchproblems

GE-IMICROECONOMICS		
CourseObjectives	**CourseOutcomes**	
Toequipthestudentswiththemethodologyof decisionmakingusingtheconceptofMicroeconomics.	CO1	Studentswillunderstandandapplyfrontier areasofMicroeconomicsprinciplethrough variousperspectiveofindividualdecisionmaking as consumers and producers.
Toimpartsomeknowledgetothestudentsabout theoriesandlawofdemandanditsimpactonthe othervariablesoftheeconomy	CO2	Studentswillbeabletoidentifydifferentmarket structures operating in an economy
To give some hands-on knowledge regarding Consumer choice theories and production theories.	CO3	Studentswillbeabletoanalysetheeconomic behaviour of consumers and firms under different markets and economic conditions.
To impart some knowledge to students regarding various markets in the economy and determination of price in such markets	CO4	Acquire problem solving skills to deal with markets and consumers using demand andsupply function
	CO5	Students will be able to apply different elasticity concepts to compute demand and supply.

	CO6	Studentswill beabletoassessthefunctioningof factormarketslikelabourmarket
GE-IIMACRO&INDIANECONOMY		
CourseObjectives	**CourseOutcomes**	
The course aims at providing the student with knowledgeofbasicconceptsofmacroeconomics.	**CO1**	Describe the nature and scope of Macroeconomics, Income, Expenditure and their Components and determinants.
To make the students understand themoderntoolsof macro-economic analysis and the policy framework is elaborated, including the open economy.	**CO2**	Analyse fiscal and monetary policy implication through IS-LM framework in short run and long run.
Tomakethestudentsunderstandthe concept, importance and theories of National Income and the various methods of measurement.	**CO3**	Comprehendthedifferenttheoriesfordemand formoney,supply of moneyapproach and working of money multiplier
To make the students understand the role and functions of Government in the Macroeconomic environment of the Nation and the various problems faced by the Nations.	**CO4**	Elucidate cause and effects of different types of inflation and trade-off between inflation and unemployment.
	CO5	Describe theroleofsavingandinvestmentin differentsizeofeconomicsontradeand exchange rate and rate of interest.
	CO6	Able toevaluatethe role of industriesin Indian economy and its industrial policies since 1948.
	CO7	Studentswillbeabletoevaluatetheroleof tertiarysectorandforeigncapitalinthe development of Indian economy

GE-IIIBUSINESSSTATISTICS	
CourseObjectives	**CourseOutcomes**
Tofamiliarizestudentswiththebasicstatistical tools used for managerial decision-making.	**CO1** Get holdofafairdegreeofproficiencyin comprehending statistical data, processing and analysing it using descriptive statistical tools
Togivesomehands-onknowledgetothestudents about some basic theories of statistics and its implicationinthebusiness.	**CO2** Congregate knowledge about various probability conceptsanddistributionsandtheirbusiness applications
Tofamiliarizethestudentsabouttheconcept of measurement of variations by using computer.	**CO3** Understand the relationship between two variablesusingconceptsofcorrelationand regressionanditsuseinidentifyingand predicting the variables.
Toimpartsomeknowledgetothestudentsabout the theories ofIndex Number andTime Series analysis and its importance in the business.	**CO4** Build up an understanding of the index numbers and their utility in daily life and stock market.
	CO5 Becomeawareofthepatternsrevealedbythe timeseriesdataandto useittomake predictions for the future.
GE-IVPRINCIPLEOFMARKETING	
CourseObjectives	**CourseOutcomes**
To understand advanced concepts, strategies and contemporaryissuesinvolvedinthemarketingof productsandservices,	**CO1** Able toassessthebasicconceptsofmarketing, marketing philosophies and environmental conditionseffectingmarketingdecisionsofa firm.
Tounderstandvariousfacetsofmarketing managementandtodeveloptheabilitytotake decisionandplan	**CO2** Understandthedynamicsofconsumerbehaviour and process of market selection through STP stages.
To execute and control marketing strategies towards attainment of organizational goals.	**CO3** Identifyandtesttheprocessofvaluecreation through marketing decisions involving product development.
Tohaveaclearunderstandingaboutthefactors affectingconsumerbehaviorandtheirinfluence on marketing practices	**CO4** Explainandexaminetheprocessofvaluecreation through marketing decisions involving product pricing and its distribution.
	CO5 Analyzingtheprocessofvaluecreationthrough marketingdecisionsinvolvingproductpromotion and also to equip them with the knowledge of various developments in marketing area that may governmarketingdecisionsofa firm.

Department of Computer Science

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

CC-1 Programmingusing	
Course Objectives	**Course Outcomes**
TolearnthebasicsoftheCprogramming language.	**CO1-**Afterthecompletionofthiscourse,thestudents Understanding Basic Programming Concepts.
Tobeabletodeveloplogicstocreate programs/applications in C.	**CO2-**Theywillusethelanguagetodevelopdifferent software
	CO3- They will be able to Improved Coding Structure.
	CO4- Students will be able to apply skill and demonstratecommunicationforemployment opportunities in the software industries
CC-2 Digital Logic	
Course Objectives	**Course Outcomes**
To understand different methods used for the simplification of Boolean functions and Binary arithmetic.	**CO1** Understand number systems, conversion, and Fixedand Floating Point representation, rules of Boolean algebra.
To design and implement combinational circuits, synchronous & asynchronous sequential circuits.	**CO2-** Understand ability to design and Analyze Logic gates.
TostudyindetailaboutSemiconductor Memory Systems	**CO3-**UnderstandBooleanalgebra,Encoder,Decoder, Multiplexer, DE multiplexers, Registers and Counter.
	CO4 Design and Implementation of Memory Units
CC3ProgrammingUsingC++	
Course Objectives	**Course Outcomes**
ToknowabouttheObjectOriented Programming concepts.	**CO1**Createsimpleprogramsusingclassesandobjects in C++.
TolearnthebasicsofC++programming language.	**CO2-**ImplementObjectOrientedProgramming Concepts in C++.

Tobeabletodeveloplogicstocreate programs/applications in C++.	**CO3-**understandhowtoleverageC++templatesto create generic algorithms and data structures
	CO4-theywilllearnhowtoestablishconnectionswith databases using C++ libraries like ODBC or MySQL Connector

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

CC4 Data Structures

Course Objectives	Course Outcomes
Tolearnhowthechoiceofdata structuresimpactstheperformanceof programs.	CO1 Students will demonstrate a comprehensive understanding of fundamental data structures including arrays, linked lists, stacks, queues, and treesand evaluating time and space complexity of programs.
To study specificdatastructuressuch as arrays, linear lists, stacks, queues, hash tables, binary trees, binary search trees, heaps and AVL trees.	CO2- Students will be able to analyze the time and space complexity of algorithms, including understanding worst-case, best-case, andaverage-case scenarios.
Tolearnefficientsearchingand sorting techniques.	CO3- Students will understand the concept of Abstract Data Types and their implementation using data structures.
	CO4-Studentswillbeabletoimplementvarious data structures using appropriate programming languages, including operationssuchasinsertion,deletion, traversal, and searching.
CC-5 Java Programming	
Course Objectives	**Course Outcomes**
TolearnthefundamentalsofObject Oriented Programming inJava environment.	CO1Studentswillbeabletoimplementavariety of data structures such as arrays, linked lists, queues, stacks, trees and graphs in Java
TolearntheuseofJavalanguageand the Java Virtual Machine.	CO2- Describe object oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
TowritesimpleJavaprogramming applications.	CO3-Studentswillbeabletodesignanddevelop user-friendly GUI applications using Java's Swing or JavaFX libraries
	CO4-Studentswillbeproficientindeveloping Java projects

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

CC-6 Database Systems	
Course Objectives	**Course Outcomes**

Tolearnthefundamentalelementsof database systems.	**CO1** Students will understandfundamental database concepts, including database structures, models, and architectures.
To learn the basic concepts of relationaldatabasemanagement	**CO2-**Database Design Theory and
systems.	Normalization
TolearnvariousSQLcommands.	**CO3-** Relational data Model and SQL
	CO4- Students will understand the concepts of transactions, concurrency control, and recovery in database systems
CC-7 DiscreteMathematicalStructures	
Course Objectives	**Course Outcomes**
Tolearnthemathmaticalfoundations for Computer Science.	**CO1**Theywilldevelopstronglogicalreasoning skills through studying topics like propositionalandpredicatelogic,enabling them to formulate logical arguments and make informed decisions.
Topics covered essential for understandingvariouscourses.	**CO2-** They will learn how number theoryconcepts like modular arithmetic and prime numbers can be applied in cryptography and data security measures for protecting data integrity.
	CO3- They will be equipped with combinatorial techniques such as permutations, combinations, and counting principles
	CO4 They will explore probability theory and statistical methods in discrete mathematics to analyze trends, patterns, and uncertainties in data, leading to informed decision-making processes.

CC-8 Operating System

Course Objectives	Course Outcomes
TounderstandOperatingsystem structure and services.	CO1 Understand fundamentals of operating system, types, system calls, system design and implementation and system structure.
To understand the concept of a Process,memory,storageandI/O management.	CO2- Identify concepts of process, operations, schedulingalgorithms,fundamentalsof threads.
	CO3- Discuss the strategies of memory

	managementandvariousmemoryallocation techniques.
	CO4-ImplementFileanddirectorystructure, disk structure and its management.
CC-9 Computer Networks	
Course Objectives	**Course Outcomes**
To learn how computers andterminals actually communicate with each other.	CO1 Describe Data Communication methodand Networking Models, Role of network in data communication and protocols. And Standards of communication.
To understand the parts of a communication network and howthey work together.	CO2-Studentswilldevelopskillsindiagnosing and resolving network issues, performing network testing and monitoring, and maintaining network performance and reliability.
	CO3Studentswillexploreconceptsrelatedto wireless networking, mobile communication, and emerging technologieslike5G,IoT,andsmart devicesthatareshapingthefutureof networking.
	CO4 Show Frequency division, Wave division Multiplexing, Time division multiplexing with examples and problems.

CC-10 Computer Graphics

Course Objectives	Course Outcomes
Tobeabletolearnthecoreconcepts of Computer Graphics.	**CO1-**Studentwillgainasolidunderstandingof fundamental concepts in computer graphics, including rasterization, rendering, modeling, and animation techniques.
To be able to create effective programsforsolvinggraphics problems.	**CO2-**IdentifythedifferentLine,circleand ellipse drawing Algorithms.
	CO3- Students will learn to create and manipulate both 2D and 3D graphics, including shapes, textures, lighting, and shading, toproduce visually appealing images and animations.
	CO4- They will be able to program graphics applications using languages such as OpenGL or DirectX, implementing rendering algorithms and graphical effects.
CC-11 WebTechnology	
Course Objectives	**Course Outcomes**
Tolearnthefundamentalsofweb designing.	**CO1-** Students will be proficient in creatingwell-structured, semantically meaningful web pages using HyperText Markup Language (HTML).
Todesignanddevelopstandardand interactive web pages.	**CO2-** Students will gain expertiseinstylingweb pages using Cascading StyleSheets(CSS), including applying styles to HTML elements, designing layouts, and creating responsive interfaces.
Tolearnsomepopularwebscripting languages.	**CO3-** Students will learn the fundamentals of client-side scripting with JavaScript, including variables, data types, control structures, functions, and event handling, and be able to use JavaScript to enhance interactivity and functionality in webpages.

	CO4 Students will understand server-side scripting with PHP and be able to develop dynamic web applications, including handling form submissions, interacting with databases, and generating dynamic content.

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

CC-12 Software Engineering	
Course Objectives	**Course Outcomes**
To learn the way of developing software with high quality and the relevant techniques.	**CO1** Students will be able to understand and apply various phases of the software development life cycle (SDLC) including requirements analysis, design, implementation, testing, deployment, and maintenance.
Tointroducesoftwareengineering principles for industry standard.	**CO2**Studentswillunderstandtheimportanceof software maintenance, evolution, and refactoring, and will be able to make necessary enhancements and updates to existing software systems.
TofocusonProjectmanagement domain and Software risks management.	**CO3**-ApplymethodsandstrategiesofSoftware design, Cohesion and coupling.
	CO4 Studentswilldevelopamindsetfor continuous learning, adaptation to new technologies and methodologies, and lifelong professionaldevelopmentinthefieldofsoftware engineering.

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

CC-13: Artificial Intelligence	
Course Objectives	**Course Outcomes**
TolearnthebasicconceptsofAI principles and approaches.	**CO1** Demonstrate fundamental understandingof the history of artificial intelligence (AI) and its foundations.
Todevelopthebasicunderstandingof the building blocks of AI.	**CO2-** Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

	CO3- Demonstrate awarenessandafundamental understanding of various applications ofAI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
	CO4-Students will understand NLP techniques such as sentiment analysis, entity recognition, andlanguagetranslation,andbeabletodevelop NLP applications using tools like NLTK or spaCy.

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

C-14 Algorithm Design Techniques	
Course Objectives	**Course Outcomes**
Tobeabletolearndesignprinciplesand concepts of algorithms.	**CO1-** Students will understandfundamental concepts in algorithm design and analysis.andanalyzingthetimeandspace complexity of algorithms using Big O notation, understanding how algorithm efficiency is affected by input size and algorithm design choices.
Tohaveamathematicalfoundationin analysis of algorithms.	**CO2-**Analyzethedifferentsortingalgorithms based on time and space.
Toanalyzeandimplementationof Graph Algorithms	**CO3-**Analyze the different approaches of designing algorithm like dynamic programming and greedy algorithms
Representationofpolynomialsin matrix representation.	**CO4-** Studentswillgainproficiencyingraphalgorithms.

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

DSE-I Numerical Techniques	
Course Objectives	**Course Outcomes**

Tolearnvariousnumerical techniques.	**CO1-** Studentswillgainasolidunderstandingof numerical methods and techniques used for solving mathematical problems that are not feasible to solve analytically.
To be able to implement different numerical techniques using programming language.	**CO2-** Students will be able toapplyrootfinding algorithmssuchasbisectionmethod,Newton-Raphson method, and secant method to find roots of nonlinear equations.
	CO3-Students willget theconcepts ofnumerical methods used for different applications.
	CO4-Studentswilllearn Numerical integration rules.

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

DES-II Unix Shell Programming	
Course Objectives	**Course Outcomes**
To learn the basics of UNIX OS,UNIXcommandsandFile system.	**CO1**UnderstandthebasicconceptsofUNIX Architecture and basic Commands.
Tofamiliarizestudentswiththe Linux environment.	**CO2-**UnderstanddifferenttypesofFiles,File system and basic file system commands.
To learn fundamentals of shell scriptingandshellprogramming.	**CO3-** Understand the commands relatedtoShell basics,vieditorandregularexpression

	commands.
Tobeabletowritesimpleprograms using UNIX.	CO4- Understand the concepts of advanced file concepts, commands related to Shell script and filter commands.

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

DSE-III Data Mining	
Course Objectives	**Course Outcomes**
Tolearnemergingissuesrelatedto various fields of data science.	CO1-Studentswilldeveloprelevant programming abilities.
To understand the underlying principles of data science, exploring data analysis.	CO2-Studentswilldemonstrateproficiencywith statistical analysis of data.
TolearnthebasicsofR Programming.	CO3-Studentswillexecutestatisticalanalyses with professional statistical software.
	CO4- Students will apply data science concepts and methods to solve problems in real world contextsandwillcommunicatethese solutions effectively

Course Objectives and Course outcomes of UG COMPUTER SCIENCE

DSE-IV Project	
Course Objectives	**Course Outcomes**
Tolearn theprocessofdeveloping projects,solvereallifeproblemsusing Softwares.	CO1 Understand the process of Software Development

	CO2-Maprealworldproblemstocomputerscience problems and solve them
	CO3- Understand process of Design, Development, Testing of a Software.
	CO4-LearnhowtodeploytheSoftwareinreal domain.

Department of History

Under graduate courses

C I: History of India-I

Course Objectives		Course Outcomes
What were the major evolutions in Ancient Indian history and how did they come about?	CO1	Describe the antiquity of India's past and methods of construction of past
What were the particular institutions and cultural elements in Indian society which may be considered different from those in other societies?	CO2	Describe the different sources which are scientifically corroborated to construct the past
Students will acquire knowledge regarding the early life and socio-cultural status of the people of ancient India. They can gather knowledge about the society, culture, religion and political history of Ancient India. They will learn about trade and urbanization of ancient civilization, like Harappan Civilization, Vedic civilizations	CO3	Describe the beginning of farming communities and scientific methods which have come up in recent years

etc

Students will be oriented to appreciate the changes and continuity in ancient India and also learn about how various sources which are corroborated in order to construct the history of Ancient India	CO4	Understand the archaeological reconstruction of Indus valley civilization and high degree of civic governance and uniformity in planning
	CO5	Understand the Vedic roots of Indic civilisation

Core II Social Formations and Cultural Patterns of the Ancient World

Course Objectives		Course Outcomes
Students will be able to understand the evolution of human society & how the society of agricultural and Animal husbandry had begun in ancient times.	CO1	Critical understanding on the interdisciplanity in understanding the evolution of homo sapiens
They also learn how the human society had transformed from nomadic to civilized society in ancient history of the World.	CO2	Develop team spirit to make group presentation on Migration, evolution, tool technology
They can acquire knowledge about the Ancient Greek polities, society and cultural life.	CO3	Skill in developing prehistoric tool technology
	CO4	Develop appreciation of the global heritage
	CO5	Appreciate the difference between Senatorial democracy and popular democracy of Rome and

C III: HISTORY OF INDIA-II (300BCE-750CE)

Course Objectives		Course Outcomes
To make students appreciate the emergence of Asokan empire. Critically understand socio-economic and political changes ushered by them	CO1	Students will be able to understand the linkages between social, political, economic and cultural processes of History
Understand the emergence of state system in the Deccan and Odisha in the post Mauryan period	CO2	They will be able to appreciate the context and the structure of the Mauryan empire and the policy of Asoka in a multicultural past of India
Understand the contribution of central Asian tribes such as Kushanas to the making a pluralistic India which had integrated with the wider world.	CO3	Able to identify various Indo Greek Coins
Such integration led to the widening of the Indic sphere of Influence	CO4	Students will be able to understand the nature of Puranic religion and how Puranic-agamic religion created a sacred geography of India
Make students appreciate the changes and excellences in various spheres in the Gupta period	CO5	
Understand the changes and continuities between ancient India and the beginning of early medieval, especially the beginning of Samanta system	CO6	

Core IV: Social Formations and Cultural Patterns of the Ancient and Medieval World-II

Course Objectives		Course Outcomes
The Course seeks to develop a historical understanding of the major developments in some parts of the Ancient and Medieval world.	CO1	Upon completion of this course the student shall be able to: Identify the main historical developments in Ancient Greece and Rome.
It gives scope for understanding the subject of slavery in its varied dimensions in the Ancient world. One of the objectives of the course is to highlight the interconnectedness of Greek and Roman religion, culture and society.	CO2	Gain an understanding of the restructuring of state and society from tribe-based polities to those based on territorial identity and citizenship.

We discuss the Medieval world in the Course by analysing the nature of European 'feudal' society and economy of the 8th to the 14th centuries.		
Explores the process of emregnce of Christiandom and Papacy and the2nd Order	CO3	Trace the emergence and institutionalization of social hierarchies and marginalization of dissent.
The objective of paper is to the making of the Three orders in Medieval Europe. By studying how the European social world shaped into an intricate structure comprising powerful institutions like monarchy and the Church.	CO4	Explain the trends in the medieval economy.
The Course provides a scope to understand the medieval economy of Western Europe, particularly through its agrarian dimensions and relatively newer labour systems like serfdom.	CO5	Analyse the rise of Islam and the move towards state formation in West Asia.

Core V: History of India-III (c.750-1206)

Course Objectives		Course Outcomes
Students will learn about the rise & growth of the Gupta's Empire in ancient India and the rise of regional Kingdoms in different parts of India after downfall of the Empire.	CO1	Understand the new periodisation and its basis

They can acquire knowledge about the society, economy and culture in early medieval India and can gather knowledge towards the Arabs Conquest of Northern part of India from this paper.	CO2	critical analysis of the relation between political realm and religious realm
Knowledge about the religious and Cultural changing scenarios especially impact bhakti cult and Tantricism.	CO3	interrelation between economy, society, polity and culture in the making of vernacular region
With its focus on multiple historiographical approaches to various issues of historical significance during this period, the course will also apprise students of the divergent ways in which historians approach, read and interpret their sources.	CO4	Debates the emergence of medieval social order, including condition of epasantary
The paper debates about urban decay and emergence of new kind of cities in early medieval	CO5	Dsicusses the nature of brahmanical social order and relations with law books which reinforced an andrcentrcbrahmanical social order
	CO6	Explain, in an interconnected manner, the processes of state formation, agrarian expansion, proliferation of caste and urban as well as commercial processes.
	CO7	Discuss the major currents of development in the

cultural sphere, namely bhakti movement, Puranic Hinduism, Tantricism, architecture and art as well as the emergence of a number 'regional' languages

CORE VI: RISE OF THE MODERN WEST – I

Course Objectives		Course Outcomes
The focus of the course is on transition from feudalism to capitalism in Europe.	CO1	Upon completion of this course the student shall be able to: Outline important changes that took place in Europe from the medieval period.
The paper familiarises the student with important transitions and transformations in the economy, polity, and socio-cultural life from late medieval period to 1600 in various parts of Europe.	CO2	Acquire an integrated approach to the study of economic, social, political and cultural developments in Europe.
The course shall critically examine the dynamics of economic and political power within Europe, and contact with the New World. The processes by which Europe's economy benefited from colonial expansion and exploitation of indigenous and slave labour will be explained.	CO3	Explain the processes by which major transitions occurred in Europe's economy, state forms, social structure and cultural life. Examine elements of early modernity in these spheres.
Students shall also engage with continuities and changes in	CO4	Critically analyse linkages between Europe's state system

intellectual and artistic realms; the social and economic milieu which influenced developments in religion;		and trade and empire.
Will understand the emergence of nation state in the aftermath of 100 year religious War	CO5	Understand the historically contingent nature of nation state in history and its locus in the Western Europe

Core VII: History of India-IV (c.1206-1526)

Course Objectives		Course Outcomes
It provides them with a basic understanding of the political, economic and socio-cultural processes of the time especially with reference to Rajput polities, Gujarat sultanate, Vijayanagarastate as well as the Delhi Sultanate. Sufism and major trends in bhakti 'movement' are explained to the students.	CO1	On completion of this course, the students shall be able to: Discuss different kinds of sources available for writing histories of various aspects of life during the thirteenth to the fifteenth centuries.
Learners are also encouraged to engage with diverse corpus of sources available to historians for the period under study.	CO2	Critically evaluate the multiple perspectives from which historians have studied the politics, cultural developments and economic trends in India during the period of study.
The objective of the course is to understand the nature of sources and nature of historical construction by analyzingtarikh tradition and historical construction by colonial, Marxist and nationalist historians	CO3	Appreciate the ways in which technological changes, commercial developments and challenges to patriarchy by certain women shaped the times.
	CO4	Crtically evaluate the way uncritical acceptance of a particular genre of historical sources would lead to a linear flat historical construction

Core VIII C Rise of the Modern West- II

Course Objectives		Course Outcomes
The paper is oriented to make students understand the making of modern Europe and growth of institutions in western Europe in its march towards modernity.	CO1	Upon completion of this course the student shall be able to: Explain major economic, social, political and intellectual developments in Europe during the 17^{th} and 18^{th} centuries.
This paper offers an in-depth historical analysis of economic, political and social transformations in Europe during the 17^{th} and 18^{th} centuries. Cyclical and secular trends in history, important political shifts, modern scientific views, and intellectual developments of the 17^{th} and 18^{th} centuries will be analysed closely.	CO2	Contextualize elements of modernity in these realms..
The paper will trace the development of socio-economic and technological forces which went into the making of the	CO3	Discuss the features of Europe's economy and origins of the Industrial Revolution.

Industrial Revolution in late 18th century Britain.

The role of trade and empire, colonial networks, and slavery will be examined to emphasize their contribution to industrial capitalism.	CO4	Analyse the relationship between trade, empire, and slavery and industrial capitalism.
The course paper deals with the divergence debate will further help draw parallels and subsequent differences between Europe and Asia, and broaden our understanding of early modern Europe.	CO5	Examine the divergence debate i.e the trajectory of History of western Europe and Asia and Africa

Core Paper IX

HISTORY OF INDIA V (c. 1526 - 1750)

Course Objectives	Course Outcome
The course draws students into a discussion on the history of India in the period between the early sixteenth and the mid-eighteenth centuries. It intends to familiarise them with internal as well as external problems and challenges that the Mughal state faced in the process of territorial expansion.	On completion of this course, the students shall be able to describe the major social, economic, political, and cultural developments of the times.
Further they are familiarise with the major strides that were made in trade, technologies and artisanal activities during this period.	Explain the intellectual ferment of the seventeenth and eighteenth centuries and its relation to state policies. Understand the

	pattern of inland trade, prevalent market practices and commerce under the Mughals
Students also get to explore state sponsored art and architecture as part of the courtly cultures. It also introduces students to contrasting religious ideologies of the time besides in-depth understanding of the land rights, trade, craft and paintings of Mughal India.	Discern the larger motives behind the Imperial patronage of art and architecture. Explain the changes and continuities in agrarian relations, land revenue regimes, Bhakti and Sufi traditions. Express the continued expansion of crafts, paintings etc.

Core X: Historical Theories and Methods

Course Objectives		Course Outcomes
It explain the major interpretive frameworks that guide modern historical writings and Identify the key elements of major contemporary theories of History.	CO1	Cognitive competence by understanding the theoretical underpinning of historical construction
Students will learn to evaluate the similarities and differences between historical theories and identify the central issues and problems that a particular historical theory addresses.	CO2	Analyse the changing discourse of history
Students will also learn the use of appropriate analytical language in discussing historical interpretations and can formulate	CO3	Critical aptitude about the nature and authenticity of sources

interpretation in historical narratives.	
CO4	Understand how historical theories shaped historical narrative in different periods
CO5	Appreciate the evolution of the discipline of history as Humanities Subject to that of a Social science discipline to integration of arcaheometry and other natural sciences in the construction of past

C-XI: History of Modern Europe- I (c. 1780-1880)

Course Objectives		Course Outcomes
They will learn about the French Revolution and its impact of European countries. Unity and power Makes people to strength which has showed in the French revolution in 1789.	CO1	At the end of the course students will be able to Identify what is meant by the French Revolution..
It shall also trace the patterns and outcomes of social upheaval throughout Europe in the first half of 19th century.	CO2	Trace short-term and long-term repercussions of revolutionary regimes and Empire-building by France.
The debates on the development and impact of industrial capitalism shall be discussed.	CO3	Understand ideological alternatives to the ideology of capitalism and
The birth of new social movements, political ideas and structures shall be contextualised within developing capitalism of the nineteenth century.	CO4	Delineate diverse patterns of industrialization in Europe and assess the social impact of capitalist industrialization.
The paper intends to explore the relation between Capitalism and Imperialism and imperial conflict and discusses theories such as theory of Lenin, Hobson and Rosa Luxemburg	CO5	Students will analyse the debates on Capitalism, development theories and conflict
Students will know about alternative to Capitalism such as Socialism, Nihilism, anarchism	CO6	Analyse patterns of resistance to industrial capital and the emerging political assertions by new social classes

C XIII: History of India-VIII (C.1857-1950)

Course Objectives		Course Outcomes
Students can acquire vast knowledge on local rebellion and movements like the Indigo rebellion, the Deccan Riots, the growth of the new middle class; the age of associations, the Aligarh movement, the Arya and the Prarthana Samaj aftermath of 1857.	CO1	After successful completion of the course, the students will be able to: Identify how different regional, religious, linguistic and gender identities developed in the late 19th and early 20th centuries.
They will learn the real historiography of Indian Nationalism; Birth of Indian National Congress, The Moderates and the Extremists, Partition of Bengal, the Swadeshi movement in Bengal in 1905.	CO2	Outline the social and economic facets of colonial India and their influence on the national movement.
They can acquire knowledge how to rise of Gandhis power in Indian politics and his activities towards the freedom like, Rowlatt Satyagraha, Khilafat and Non-cooperation movement, The Swarajya party, Poona Pact, Civil Disobedience Movement, Quit India Movement.	CO3	Explain the various trends of anti-colonial struggles in colonial India.
They also learn how to raise	CO4	Analyse the complex

communal politics and opposition politics on the eve of the Freedom movement in India and aftermath of partition in India		developments leading to communal violence and Partition.
The paper deals with the making of independence and Constitutionmaking in search of an equalitariana democratic society	CO5	Discuss the negotiations for independence, the key debates on the Constitution and need for socio-economic restructuring soon after independence

Core XIV: HISTORY OF MODERN EUROPE II (c. 1880 - 1939)

Course Objectives		Course Outcomes
Students will learn about the post-war developments of Social, Political and Economic scenarios of theWorld and decolonization and the emergence of the Third world.	CO1	Upon completion of this course the student shall be able to: . Trace varieties of nationalists and the processes by which new nation-states were carved out.
They will learn about changing world political scenarios and emerging trends in culture, media and Revolution among European countries.	CO2	Discuss the peculiarities of the disintegration of large empires and remaking of Europe's map.
It deals with the nature and impact of Imperialism between the two wars	CO3	Deliberate on the meaning of imperialism and the manifestations of imperialist rivalry and expansion in the 19th and early 20th century.
It deals with rise of Totalitarian regimes	CO4	Analyse the conflict between radical and conservative forces, and the gradual consolidation of

	ultra-nationalist and authoritarian regimes in Europe. (
The paper deals with new movements in art and literature such as existentialism	CO5	Contextualise major currents in the intellectual sphere and arts

DSE-II

HISTORY AND CULTURE OF ODISHA-II Course Objectives	Course Outcome
This course paper will make the students familiar with the political and administrative history of the Afghans, Mughals and the Marathas in Odisha.	At the end of the course students will be able appreciate the impact of Moghul and Maratha rule on structure of Gajapati Kingship.
This will also help in understand and assess the nature, causes and impact of the several resistance movements in the 19th century Odisha with a special reference to the Paik rebellion of 1817.	Students will be able analyse the nature of insurgency of the subaltern class.
The paper will critically evaluate the process through which Odia nationalism grew	Debate about the nature and consequence of Odia nationalism and its basis
The paper also maps the growth of regional and national consciousness in Odisha	Students will analyse the tropes of nationalism and region in core and marginal areas of Odia speaking people
It explores the process of the merger of princely states and the interrogates the basis of linguistic nationalism	Students will understand the process of the making of the present day administrative boundary of Odisha

DSE III: History and Culture of Odisha- III

Course Objectives		Course Outcomes
This paper contextualizes the emergence and spread of Puranic religions	CO1	Student analyses the process of integration of tribal cult into the brahmanical religions and emergence of Jagannath cults
The paper deals with persistence of heterodoxies such as Buddhism and Jainism and Atimarga orders such as Kapalikas and Kaulas	CO2	Students will explore the social context of the continuities of Buddhism as well the strong footing of Ati Marga and Mantra Marga traditions that challenged

		existing brahmanical social and religious orders
It attempts to study the evolution of Kalinga architecture	CO3	Students will appreciate the stylistic features of Kalinga temple
The paper deals with evolution of brahmanical sculptures and narrative art in agamic temples	CO4	Students will appreciate the stylistic features of Kalinga temple art
It deals with the evolution of Odisa script and language and the making of the cultural region of Odisha	CO5	Students will develop teamwork and enhance communication skill by making PPT and presenting them in class after field visit

DSE IV: Dissertation

Course Objectives		Course Outcomes
The paper is a project based problem solving paper	CO1	At the end of the course students will be able to Write dissertation on their respective research interest areas
It makes people learn basic steps in pursuing research	CO2	It enables students to peruse through existing body of literature through literature review
Its objective is to make students explore primary source, identifies research problem and hypothesiss, identify primary and secondary sources	CO3	It enable students identify primary and secondary sources and analyse them
It intends students to use both qualitative and quantitative methods in research	CO4	Students develop analytical skill
It makes students learn footnoting, endnoting bibliography	CO5	Students understand that pursuing research is a scientific and systematic process

GE- I: History of India-I (Early Times to 1750)

Course Objectives		Course Outcomes
The paper intends to make students aware of the major events in the Indian History	CO1	After the end of the course, students will be able to Identify major milestones in Indian history
The paper enables students understand varius kinds of sources used in construction of Indian history	CO2	Understand that there are several contested histories and there is no singular narrative of the past
The paper deals with continuities and changes in Indian History	CO3	Critically anlyse the nature of historical sources and corresponding historical construction
The paper enables the transition to early emdievala and medieval in Indian History	CO4	Explore various narratives of the past
Its objective is to make students appreciate Indian art, architecture, religion and intellectual thoughts	CO5	Develop appreciatin of the pluralities of India's past

GE II: History of India – II (1750-1950)

Course Objectives		Course Outcomes
Students of history will learn how to raise regional powers in India after the downfall of the Mughal Empire and in the course of time how to rise of the Company's absolute power in India.	CO1	Appreciate the relation between capitalism and colonialism in the context of a colonial country like India
They can understand about the colonial nature of state during 200 years rule of the British power in this land.	CO2	Understand the domestic political economic and foreign policy that operated from the standpoint of the British Imperialism

They can gather knowledge about how the Indian society, politics, religion and economy had changed during the Company's rule in India.	CO3	Analyse the discourses of Development by the Raj and the incidental benefits of such development on national consciousness
They will understand how the company's economic exploitation made Indian revolutionary against the British rule.	CO4	Critically examines the coercive and hegemonic basis of the Raj
That ultimately paved the background of the Great Revolt of 1857.	CO5	Students will be able to develop team to discuss on the nature of 1857 Revolt
Students will learn the theoretical aspects of nationalism and its different variants and how this led to struggles of various types against colonial Raj	CO5	Understand the nature of its nationalism and its primrdial root and how this led to struggles of various types against colonial Raj

Department of Mathematics

Dhenkanal (Auto.) College, Dhenkanal.

Program Outcomes and Course Outcomes

Program Name: B.A. / B.Sc. in Mathematics

The current trend in higher education is transitioning from a teacher-centric approach to a learner-centric one. As part of this goal, the UGC has implemented a curriculum framework for undergraduate education based on learning outcomes. This framework is designed specifically for B.Sc. (Hons.) Mathematics, aiming to equip students not only with mathematical knowledge and skills but also with versatile competencies applicable across various domains. These competencies are vital for personal growth, employment prospects, and further education in a global context. The program and course learning outcomes are clearly defined to facilitate understanding for prospective students, parents, and employers, ensuring adherence to national and international standards while promoting student mobility.

Nature and extent of the B.A / B.Sc. (Hons.) Mathematics

Mathematics is usually described as the abstract science of number, quantity and space along with their operations. The scope of Mathematics is very broad and it has a wide range of applications in natural sciences, engineering, economics and social sciences. B.A./B.Sc. (Hons.) Mathematics Program aims at developing the ability to think critically, logically and analytically and hence use mathematical reasoning in everyday life. Pursuing a degree in mathematics will introduce the students to a number of interesting and useful ideas in preparations for a number of mathematics careers in education, research, government sector, business sector and industry.

Program Outcomes

The completion of the B.A./B.Sc. (Hons.) Mathematics Program will enable a student to:

- Communicate mathematics effectively by written, computational and graphic means.
- Create mathematical ideas from basic axioms.
- Gauge the hypothesis, theories, techniques and proofs provisionally
- Utilize mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis
- Identify applications of mathematics in other disciplines and in the real-

world, leading to enhancement of career prospects in a plethora of fields and research

COURSE STRUCTURE FOR MATHEMATICS HONORS

Semester	Course	Course Name	Credits
I	AECC-I	AECC-I	04
	C-I	Calculus	04
	C-I	Practical	02
	C-II	Discrete Mathematics	05
	C-II	Tutorial	01
	GE-I	GE-I	05
	GE-I	Tutorial	01
			22
II	AECC-II	AECC-II	04
	C-III	Real Analysis	05
	C-III	Tutorial	01
	C-IV	Differential equations	04
	C-IV	Practical	02
	GE-II	GE-II	05
	GE-II	Tutorial	01
			22
III	C-V	Theory of Real functions	05
	C-V	Tutorial	01
	C-VI	Group Theory-I	05
	C-VI	Tutorial	01
	C-VII	Partial differential equations and system of ODEs	04
	C-VII	Practical	02

	GE-III	GE-III	05
	GE-III	Tutorial	01
	SECC-I	SECC-I	04

			28
IV	C-VIII C-VIII	Numerical Methods and Scientific Computing Practical	04 02
	C-IX C-IX	Topology of Metric spaces Tutorial	05 01
	C-X C-X	Ring Theory Tutorial	05 01
	GE-IV GE-IV	GE-IV (Theory) Tutorial	05 01
	SECC-II	SECC-II	04
			28
Semester	Course	Course Name	Credits
V	C-XI C-XI	Multivariable Calculus Tutorial	05 01
	C-XII C-XII	Linear Algebra Tutorial	05 01
	DSE-I DSE-I	Linear Programming Tutorial	05 01
	DSE-II DSE-II	Probability and Statistics Tutorial	05 01
			24
VI	C-XIII C-XIII	Complex analysis Tutorial	05 01
	C-XIV C-XIV	Group Theory-II Tutorial	05 01
	DSE-III DSE-III	Differential Geometry Tutorial	05 01
	DSE-IV	Number Theory/Project	06
			24

		TOTAL	**148**

B.A./B.SC.(HONOURS)-MATHEMATICS

CORE PAPER-1

CALCULUS

Course Objective: The main emphasis of this course is to equip the student with necessary analytic and technical skills to handle problems of mathematical nature as well as practical problems. More precisely, main target of this course is to explore the different tools for higher order derivatives, to plot the various curves and to solve the problems associated with differentiation and integration of vector functions.

Course Outcomes: After completing the course, students are expected to be able to use Leibnitz's rule to evaluate derivatives of higher order, able to study the geometry of various types of functions, evaluate the area, volume using the techniques of integrations, able to identify the difference between scalar and vector, acquired knowledge on some the basic properties of vector functions.

CORE PAPER-II

DISCRETE MATHEMATICS

Course Objectives: This is a preliminary course for the basic courses in mathematics and all its applications. The objective is to acquaint students with basic counting principles, set theory and logic, matrix theory and graph theory.

Course Outcomes: The acquired knowledge will help students in simple mathematical modeling. They can study advance courses in mathematical modeling, computer science, statistics, physics, chemistry etc.

CORE PAPER-III

REAL ANALYSIS

Course Objective: The objective of the course is to have the knowledge on basic properties of the field of real numbers, studying Bolzano-Weierstrass Theorem, sequences and convergence of sequences, series of real numbers and its convergence etc. This is one of the core courses essential to start doing mathematics.

Course Outcome: On successful completion of this course, students will be able to handle fundamental properties of the real numbers that lead to the formal development of real analysis and understand limits and their use in sequences, series, differentiation and integration. Students will appreciate how abstract ideas and rigorous methods in mathematical analysis can be applied to important practical problems.

CORE PAPER-IV

DIFFERENTIAL

EQUATIONS

Course Objectives: The objective of this course is to familiarize the students with various methods of solving differential equations and to have qualitative applications through models. The students have to solve problems to understand the methods.

Course Outcomes: A student completing the course is able to solve differential equations and is able to model problems in nature using Ordinary Differential Equations. This is also prerequisite for studying the course in Partial Differential Equations and models dealing with Partial Differential

Equations.

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Course Objective: The objective of the course is to have knowledge on limit theorems on functions, limits of functions, continuity of functions and its properties, uniform continuity, differentiability of functions, algebra of functions and Taylor's theorem and, its applications. The student how to deal with real functions and understands uniform continuity, mean value theorems.

Course Outcome: On the completion of the course, students will have working knowledge on the concepts and theorems of the elementary calculus of functions of one real variable. They will work out problems involving derivatives of function and their applications. They can use derivatives to analyze and sketch the graph of a function of one variable, can also obtain absolute value and relative extrema of functions. This knowledge is basic and students can take all other analysis courses after learning this course.

CORE PAPER-VI

GROUP
THEORY-I

Course Objectives: Group theory is one of the building blocks of modern algebra. Objective of this course is to introduce students to basic concepts of group theory and examples of groups and their properties. This course will lead to future basic courses in advanced mathematics, such as Group theory-II and ring theory.

Course Outcomes: A student learning this course gets idea on concept and examples of groups and their properties. He understands cyclic groups, permutation groups, normal subgroups and related results. After this course he

can opt for courses in ring theory, field theory, commutative algebras, linear classical groups etc. and can be apply this knowledge to the problems of X-ray Crystallography, Coding Theory, Cryptography, organic chemistry (dihedral group), etc.

CORE PAPER-VII

PARTIAL DIFFERENTIAL EQUATIONS AND SYSTEM OF ODEs

Course Objectives: The objective of this course is to understand basic methods for solving Partial Differential Equations of first order and second order. In the process, students will be exposed to Charpit's Method, Jacobi Method and solve wave equation, heat equation, Laplace Equation etc. They will also learn classification of Partial Differential Equations and system of ordinary differential equations.

Course Outcomes: After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, non-linear evolution equations etc. The students can analyze the boundary value problems involving engineering disciplines and industrial applications.

CORE PAPER-VIII

NUMERICAL METHODS AND SCIENTIFIC COMPUTING

Course Objectives: Calculation of error and approximation is a necessity in all real life, industrial and scientific computing. The objective of this course is to acquaint students with various numerical methods of finding solution of

different type of problems, which arises in different branches of science such as locating roots of equations, finding solution of systems of linear equations and differential equations, interpolation, differentiation, evaluating integration.

Course Outcomes: Students can handle physical problems to find an approximate solution. After getting trained a student can opt for advance courses in numerical analysis in higher mathematics. Use of good mathematical software will help in getting the accuracy one need from the computer and can assess the reliability of the numerical results, and determine the effect of round off error or loss of significance.

CORE PAPER-IX
TOPOLOGY OF METRICSPACES

Course Objectives: This is an introductory course in topology of metric spaces. The objective of this course is to impart knowledge on open sets, closed sets, continuous functions, connectedness and compactness in metric spaces.

Course Outcomes: On successful completion of the course students will learn to work with a general topological space. The students can analyze the corresponding differences in results on real line. This is a foundation course for all analysis courses in future.

CORE PAPER-X
RING THEORY

Course Objectives: This is a second course in modern algebra which deals with ring theory. Some basics of ring theory like rings, subrings, ideals, ring homomorphisms and their properties and. This course is an integral part of

any course on Modern algebra the others being Group theory and Field Theory.

Course Outcomes: After completing this course, this will help students to continue more courses in advanced Ring theory modules, Galois groups. The students can apply the results on polynomial rings in applied sciences.

CORE PAPER - XI
MULTIVARIATE CALCULUS

Course Objectives: The objective of this course to introduce functions of several variables to a student after he has taken a course in one variable calculus. The course will introduce partial derivatives and several of its consequences and will introduce double and triple integrals along with line integrals which are fundamental to all streams where calculus can be used.

Course Outcomes: After completing this course the students will be able to calculate partial derivatives, directional derivatives, extreme values and can calculate double, triple and line integrals. They will have idea of basic vector calculus including green's theorem, divergence theorem and stokes theorem. They can take courses in calculus on manifolds, Differential geometry and can help in numerical computations involving several variables.

CORE PAPER – XII LINEAR ALGEBRA

Course Objectives: Linear algebra is a basic course in almost all branches of science. A full course in undergraduate program will help students in finding real life applications later. The objective of this course is to introduce a

student the basics of linear algebra and some of its application.

Course Outcomes: The students will be able to understand the notion of vector space and linear transformation. The students will be understand the concepts of rank and nullity. The students will acquire knowledge in eigen values and eigen vectors of matrices. The students can apply the concepts learned in this subject in many areas of computer science, finance mathematics, industrial mathematics, bio mathematics etc.

CORE PAPER-XIII
COMPLEX ANALYSIS

Course Objectives: The objective of the course is aimed to provide an introduction to the theories for functions of a complex variable. The concepts of analyticity and complex integration are presented. The Cauchy's theorem and its applications, the calculus of residues and its applications are discussed in detail.

Course Outcomes: Students will be able to handle certain integrals not evaluated earlier and will know a technique for counting the zeros of polynomials. This course is prerequisite to many other advance analysis courses.

CORE PAPER-
XIV GROUP-
THEORY-II

Course Objectives: The objective of this course **i**s to be exposed to more advanced results in group theory after completing a basic course. The course introduces results on automorphism, commutator subgroup, group action Sylow theorems etc.

Course Outcomes: The course will enable students to learn about automorphisms for constructing new groups from the given group. The students can understand fundamental theorem of finite abelian groups. They can be familiar with group actions and conjugacy in‡ S_n, and uerstand Sylow

theorems and their applications.

Discipline Specific Elective Paper-1

LINEAR PROGRAMMING

Course Objectives: The objective of this course is to familiarize industrial problems to students with various methods of solving Linear Programming Problems, Transportation Problems, Assignment Problems and their applications. Also, students will know the application of linear Programming method in Game Theory.

Course Outcomes: More knowledge on this topic in higher studies will help students to deal industrial models. This is also prerequisite for studying advanced courses in Nonlinear Programming Problems, Inventory Control Problem and Queuing Theory etc.

Discipline Specific Elective Paper-II

Probability and Statistics

Course Objectives: The objective of the course is to expertise the student to the extensive role of statistics in everyday life and computation, which has made this course a core course in all branches of mathematical and engineering sciences.

Course Outcomes: This course will enable the students to learn about probability density and moment generating functions. They will learn know about various univariate distributions such as Bernoulli, Binomial, Poisson, gamma and exponential distributions and also learn about distributions to study the joint behavior of two random variables and understand various multivariate distributions. They will learn law of large numbers and shall be able to do basic numerical calculations.

Discipline Specific Elective Paper-III

DIFFERENTIAL GEOMETRY

Course Objectives: After learning methods on curve tracing and Analytic Geometry, the objective of this course is to teach Differential geometry of curves and surfaces which trains a student using tools in calculus to derive intrinsic properties of plain curves and space curves.

Course Outcomes: After completing this course a student will learn on serret-Frenet formulae, relation between tangent, normal and binormals, first and second fundamental forms and ideas on various curvatures. He has scope to take more advanced courses in surface theory and geometry.

Discipline Specific Elective Paper-

IV PROJECT

Course Objectives: The objective of this course is to enhance skill and thinking potential to possess comprehensive depth in any of the recent topics of Mathematics which will enable students for framing mathematical modeling of various real life problems and hence solving them.

Course Objectives: The students will acquire significant ideas for carrying out independent work in research and development. The students will be able to identify many problems and solve them while addressing the challenges of real-life problems.

DEPARTMENT OF PHYSICS

PROGRAMME OUTCOMES (PO)

B.Sc. Physics (Hons.)

1. DemonstrateKnowledge: Studentsshouldhaveacomprehensiveunderstandingofthefundamental principles and theories of physics, including classical mechanics, electromagnetism, thermodynamics, quantum mechanics, and relativity.

2. Problem-SolvingSkills: Developtheabilitytoapplyphysicsconceptstosolvecomplexproblemsin various contexts, demonstrating analytical and critical thinking skills.

3. ExperimentalSkills: Gainproficiencyinconductingexperiments,collectingdata,andanalyzingresults using laboratory equipment and techniques relevant to physics.

4. MathematicalProficiency: Applyadvancedmathematicaltechniques,includingcalculusand differential equations, to model and solve physics problems.

5. QuantitativeAnalysis: Usequantitativereasoningtodescribephysicalphenomenaandrelationships, interpret data, and draw meaningful conclusions.

6. ScientificMethod: Understandandapplythescientificmethod,includinghypothesisformulation, experimental design, data analysis, and reporting results.

7. CommunicationSkills: Developeffectivecommunicationskillstopresentscientificfindingsthrough written reports, oral presentations, and technical documentation.

8. ComputerSkills: Gainproficiencyinusingcomputersoftwareandprogramminglanguagessuchas Scilab, Matlab, c++, python etc. for data analysis, simulations, and modeling in physics.
9. CriticalThinking: Cultivatetheabilitytocriticallyevaluatescientificliteratureandassessthevalidity of research findings in the field of physics.
10. EthicalandProfessionalConduct: Adheretoethicalstandardsinresearchandpractice, demonstrating integrity and responsibility in scientific inquiry.
11. InterdisciplinaryUnderstanding: Recognizetheinterdisciplinarynatureofphysicsandits connections to other fields of science and technology.
12. ModernPhysicsKnowledge:Acquireknowledgeofmodernphysicstopics,suchasparticlephysics, nuclear physics, condensed matter physics, and astrophysics.
13. ProblemIdentification: Identifyreal-worldproblemsandchallengesthatcanbeaddressedthrough the application of physics principles.
14. IndependentLearning: Fosterasenseofcuriosityandlifelonglearning,enablingstudentstostay updated with advancements in the field of physics.
15. Teamwork: Collaborateeffectivelywithpeersingroupprojectsandexperiments,understandingthe value of teamwork in scientific research.
16. PreparationforAdvancedStudies: Preparestudentsforfurtherstudiesinphysicsorrelatedfieldsat the graduate level and to provide a foundation for students to pursue careers in research, academia, industry, or other fields that require a strong background in physics.

CORE1(MATHEMATICALPHYSICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Tounderstanddifferentialequationsi.e. ordinary differential equations with constant coefficients, first order ODE's with variable coefficients, second order ODE's partial differential equations, the wave equation and the heat equation, and application of Green's function.	Students will be able to describe and explaindifferentmathematicaltoolsuseful in Physics
2	Tounderstandbasicsofvectoralgebra like scalar product and vector product	Students will be able to understand and explainvectoralgebraandvectorcalculus and associated theorems.
3	To understand vector calculus like divergence,gradient,curl,indifferent coordinatesystemsandtheirphysical interpretation	The students will be able to understand andapplyordinarydifferentialequations describingdifferentphysicalphenomena and their solutions
4	To understand various theorems like divergencetheorem,Green'stheorem, Stokes' theorem etc.	Students can understand and prove varioususefultheoremslikedivergence theorem, Green's theorem, Stokes' theorem etc.

CORE–2 (MECHANICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Tounderstandthedynamicsofrotating objects i.e. rigid bodies, angular velocity, the moment of inertia, the motion of rigid bodies, non-inertial frames, pseudo forces, examples involving the centrifugal force and coriolis force.	Thestudentswillbeabletounderstandand explain the concepts of special theory of relativity and its effect on motion of bodies when observed in different frames of references
2	To understand the basics of material properties like, elasticity, elastic constantsandtheirrelation,torsionofa cylinder, bending of a beam, cantilever, beam supported at its ends and loaded inthemiddle.	Studentscanbeabletounderstandthe special theory of relativity and its applications.

3	To understand laws of motion, referenceframes,anditsapplications, idea of conservation of angular momentum, central forces and the motion under central forces like gravitationalforce,Kepler'slawsof planetary motion, satellites, global positioning system.	Thestudentswillbeabletounderstandthe basic concepts involving translational motion,circularmotion, rotational motion, oscillatory motion and motion of fluids Thestudentswillbeabletounderstandand explain the concepts of special theory of relativity and its effect on motion of bodies when observed in different frames of references.
4	To understand Simple Harmonic Oscillations. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Equation of motion and solution(,casesofoscillatory,critically damped and over damped) Forced oscillations: Transient and steady states; Resonance, sharpness of resonance	Students can understand and describe simple harmonic motion, damped oscillation,forcedoscillationandresonance
CORE–3(ELECTRICITY&MAGNETISM)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Tounderstandthebasicconceptsof electric fields.	Thestudentswillbeabletoexplainthe basic concepts and interrelationship between electric current and different laws.
2	Tounderstandthebasicconceptsof magnetic fields.	The students will be able to explain the basic concepts and interrelationship betweenelectriccurrentandmagnetism.
3	To gain knowledge on properties of dielectric materials and electromagneticinductionprinciples and its applications	Studentswillbeabletoexplaindifferent dielectric materials.

4	Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits, ComplexReactanceandImpedance, Series LCR Circuit: (1) Resonance (2) PowerDissipation(3)QualityFactor, (4) Band Width, Parallel LCR Circuit. Network theorems: Ideal Constant-voltageandConstant-currentSources, Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem, Applications to DC circuits. Transient Currents Growth and decay ofcurrentinRCandLRcircuits.	Thestudentswillbeabletoexplainabout network theorems to understand the complicated networksand simplifythem.

CORE–4(WAVES&OPTICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Tounderstandphenomenonbasedonlight and related theories.	The students will be able to understand and analyses the optical phenomena like reflection,refraction,diffraction,interference andpolarizationoccurringintheirsurrounding
2	Togetskillstoidentifyandapplyformulas of optics and wave physics	Students will understand and describe the physics behind natural phenomena like formationofrainbow,bluecolourofskyetc.
3	Tounderstandtheprincipleslikereflection, refraction, interference, diffraction, polarization etc. and applications of these phenomena and the applications of interference in design and working of interferometers.	Students will be able to explain about optical principles like total internal reflection and its applicationsandprinciplesbehinddesigningof interferometers, spectrometers

4	TounderstandSingleslit,Circularaperture, ResolvingPowerofatelescope,Doubleslit, Multiple slits, Diffraction grating, Resolving power of grating. Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half- Period Zones for Plane Wave, Explanation of Rectilinear Propagation of Light, Theory of a Zone Plate: Multiple Foci of a Zone Plate,Fresnel'sIntegral,Fresneldiffraction patternofastraightedge,aslitandawire.	Students can understand and explain the RectilinearPropagationofLight,Theoryofa Zone Plate: Multiple Foci of a Zone Plate, Fresnel'sIntegral,Fresneldiffractionpattern of a straight edge, as lit and a wire.

CORE–5(MATHEMATICALPHYSICS-II)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	TounderstandtheFourierseriesexpansion of periodic and nonperiodic functions and their importance.	Thestudentswillbeableto understandand explainthetechniquesofproblemsolving in PhysicsbytheuseofFourier series
2	To be able to solve Singular Points of Second OrderLinearDifferential Equationsandtheirimportance,Singularities ofBessels and Laguerre Equations, Frobenius method and its applications to differential equations:LegendreandHermiteDifferential Equations,LegendreandHermite Polynomials: Rodrigues Formula, Generating Function,Orthogonality.	The students will be able to solve ordinary differential equations using standard procedureslikeseparationofvariables,series expansion (Fourier-type series) and integral transforms.
3	To understand Simple recurrence relations of Legendre and Hermite Polynomials, Expansion of function in a series of LegendrePolynomials,AssociatedLegendre Differential Equation, Associated Legendre polynomials,SphericalHarmonics	Studentswillbeabletoexpandfunctionina series of Legendre Polynomials, Associated Legendre Differential Equation, Associated Legendre polynomials, Spherical Harmonics
4	To understand the Solutions to partial differential equations using separation of variables:Laplace'sEquationinproblemsof rectangular, cylindrical and spherical symmetry. Conducting and dielectricsphere in an external uniform electric field. Wave equation and its solution for vibrationalmodesofastretchedstring	Students will be able to understand about Laplace'sEquationinproblemsofrectangular, cylindrical and spherical symmetry.

CORE–6(THERMAL PHYSICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Tounderstandthedifferentlawsof thermodynamics.	The students will be able to understand the basic phenomena in Physics related to heat, temperatureandthermodynamicallawsand systems

2	Tounderstandthelawsofthermodynamics and principles of free energy; describe thermodynamic processes and heatenginesandmastertheuseofthechemical potential to describe diffusive equilibrium, phase equilibrium and chemical processes, phase transition	Thestudentswillbeabletoexplainaboutthe physical parameters associated with thermodynamic behavior of a system like entropy, internal energy, enthalpy, free energy etc.
3	Tounderstandaboutkinetictheoryof gases	Studentswillbeabletoknowdistributionof velocities, molecular collisions, transport phenomenon of ideal gases
4	Tounderstandthebehaviorofrealgaseous systems.	Studentswillbeabletoexplaindifferent aspects of real gaseous systems

CORE–7(ANALOGSYSTEMSANDAPPLICATIONS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	To understand the basics of p-n junction diodeslikebarrierformation,currentflow mechanism; application as rectifiers and some special diodes like Zener diode, photodiodeandsolarcells	The students will be able to understand the principle, working and characteristics of electronic devices like diodes and their applicationsasrectifierstransistors,opamps etc.
2	To understand the basics of bipolar junctiontransistorsandtheiroperation andtheirapplicationsasamplifiersand oscillators.	Students will know about the biasing of transistorsandtheiruseasamplifiersandas oscillators
3	Tounderstandofprincipleandworkingof operational feedback amplifiers and their application in different mathematical operations.	Thestudentswillunderstandthefeedback mechanism in opamps and their different applications.
4	To study the characteristics of Inverting and non-inverting amplifiers, Adder SubtractorDifferentiator,IntegratorLog amplifier, Zero crossing detectorWein bridgeoscillator.	Thestudentswillbeabletounderstandthe functions of basic home appliances.

CORE–8(MATHEMATICALPHYSICS–III)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**

1	Tounderstandtheconceptsofcomplex numbers, analytic functions and theorems like Residue theorem. The emphasis of the course is on applications in solving problems of interesttophysicists.Studentsaretobe examined on the basis of problems; knownorunknown.	Thestudentswillbeabletoexplainthebasic concepts like Fourier transforms, Laplace transforms etc.
2	TounderstandtheconceptsofFourier transforms and their derivatives in different physical phenomena	Studentswillbeabletounderstandthe integraltransformstosolvedifferential equations.
3	TounderstandtheconceptsofFourier transforms and their applications in different physical phenomena	Studentswillbeabletounderstandthe integraltransformstosolvedifferential equations.
4	To understand the concepts of Laplace transforms and their applications in differentphysicalphenomenalikesimple harmonic oscillation, heat transfer and electrical circuits.	Students will have mathematical skill to formulate, solve and understand the underlyingequationsindifferentbranchesof physics like thermodynamics and electromagnetic theory.

CORE–9(ELEMENTSOFMODERNPHYSICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Tounderstandthegradualrefiningof proposed models by experiments to describe the structure of atoms and nuclei.	Students will be able to understand and explainthenuclearforcesanditsproperties
2	To understand the dual nature of matter andexperimentsthatdescribestheeither nature.	Studentswillunderstandandexplaindifferent nuclear decay processes
3	TounderstandthepropertiesofNucleus	Students can understand and explain about thesizeandpropertiesofNucleus,Natureof Nuclear force and nuclear models
4	To study Radioactivity, stability of the nucleus, Law of radioactive decay, Mean lifeandHalflifeAlphadecay,Betadecay-energy released, spectrum and Pauli's prediction of neutrino, Gamma ray emissionenergy,Nuclearreactor.	Studentswillbeabletostudyenergyreleased in nuclear reactor.

CORE–10(DIGITALSYSTEMSANDAPPLICATIONS)

UNIT	COURSEOBJECTIVE	COURSEOUTCOME
1	Tounderstandthefundamentalsof different components of ICs	The students will be able to understand and explaintheVLSItechnologyandfabricationof ICs, and logic gates
2	TounderstandtheBooleanlaws	Studentswillbeabletounderstandand explain about Boolean Algebra
3	To understand the evolution and performanceofthememorycircuits, data processinglogic circuits used in computers.	Students will be able to understand and explainabouttheversatilityof555Icandits applications.
4	To understandthe developmentofICs forrapidprogressofelectronicscience and technology.	Students will be able to understand and explainaboutthedifferentpartsofComputer

CORE–11(QUANTUMMECHANICSANDAPPLICATIONS)		
UNIT	COURSEOBJECTIVE	COURSEOUTCOME
1	Tounderstandtheoriginsofquantum mechanicsandexplainthedifferences between classical and quantum mechanics	Studentswillbeabletounderstandand explainthequantummechanicsandthe inadequacies in classical mechanics
2	Tounderstandtheoperatorformalism	Thestudentswillbeabletounderstandand explain the idea of operator formalism
3	To understand the Schrödinger wave mechanicsandSolvingtheSchrödinger equation for simple 1D time-independentpotentials	StudentswillbeabletosolveSchrödinger equation and Eigen value problems
4	To appreciate the importance, identify andrelatetheEigenvalueproblemsfor energy, momentum, angular momentumandcentralpotentials	Studentswillunderstandandsolvetheidea about different coupling mechanisms

CORE–12(SOLIDSTATE PHYSICS)		
UNIT	COURSEOBJECTIVE	COURSEOUTCOME

1	To understand the basics of crystal structure: lattice, basis, unit cells, reciprocallatticeconceptanddiffraction experiment	Thestudentswillunderstandandexplainthe crystal structures of solids
2	To understand crystal vibrations: phononheatcapacityandthermal conductivity	Studentswillbeabletodeterminecrystal structure of solids
3	Tounderstandthedielectric,magnetic properties of materials and theory of superconductivity which are frontier areas of research today.	Thestudentswillbeabletounderstandand explain the magnetic, dielectric and optical properties of solids
4	To understand electrons in periodic potential: energy bands theory classificationofmetals,semiconductors and insulators	Students will be able to understand and explaintheconceptofsuperconductivityand its applications

CORE–13(ELECTROMAGNETICTHEORY)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Tounderstandtheconceptsbehind Maxwell equations.	Studentscanunderstandandexplainthe concepts of Maxwell equations.
2	Tounderstandelectromagneticwave propagation in different type of unbounded mediums.	Students will be able to understand and explainelectromagneticwavepropagationin different type of mediums.
3	Tounderstandelectromagneticwave propagation in different type of bounded mediums	Students will be able to understand and explainelectromagneticwavepropagationin different type of mediums.
4	TounderstandpolarizationofEM waves, polarizing and analyzing instruments	Studentswillbeabletounderstandand explainaboutpolarizationoflight,wave plates etc

CORE–14(STATISTICAL MECHANICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**

1	Evaluation of the laws of classical thermodynamicsformacroscopic systemsusingthepropertiesofits atomic particles.	Students will be able to understand and explaintheconceptofclassicalstatistical mechanics
2	Understand the nature of statistical errorsandvariationsofthermodynamic parameters.	Students will be able to understand and explaintheconceptsofquantumstatistical mechanics
3	Understandmicroandmacrostates, fermions and bosons	Studentswillbeabletounderstandand explain about fermions, bosons
4	Understandradiationandradiationlaws	Students will be able to understand and explainthevariouslawsonradiationlike Planck's law, Stefan's law etc.

DSE–1 (CLASSICALDYNAMICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	To demonstrate knowledge and understanding of the following fundamentalconceptsinthedynamics of system of particles, motion of rigid body, Lagrangian and Hamiltonian formulationofmechanics	Students will understand and explain the basicmechanicalconceptsrelatedtodiscrete and continuous mechanical systems
2	Torepresenttheequationsofmotion for complicated mechanical systems usingtheLagrangianandHamiltonian formulationofclassicalmechanics.	Studentswilldescribeandunderstandplanar and spatial motion of a rigid body,
3	SpecialTheoryofRelativity	Studentswillbeableunderstandthespecial theory of relativity.
4	Four Vectors	Students will be able to understand and explainaboutfourvelocityandacceleration, conservation of four momentums.

DSE–2(NUCLEARANDPARTICLE PHYSICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Understand the ideas of basics of nucleus and its constituent particles, radioactivityandprocesseslikefission and fusion.	Students will be able to understand and explainthebasicsofnuclearstructureand radioactivity

2	Understandbasicknowledgeaboutthe Standard Nuclear Model	Studentswillbeabletounderstandand explain dark matters
3	A basic understanding of nuclear radiationsandparticleaccelerators.	Studentswillabletoexplainandunderstand the detection of nuclear radiation
4	Ability to apply fundamental conservationlawsandsymmetriesto judge the viability of production and decay processes for nuclei and elementaryparticles.	Studentswillbeabletounderstandand explain standard model

DSE–3(NANOMATERIALSANDAPPLICATIONS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Understand the effect of dimensionalityoftheobjectatNano scale on their properties;	Studentswillbeabletounderstandand explain the properties of materials at nanoscale
2	Understandsynthesistechniqueto control size and shape of nanomaterials and their future applications in industry	Studentswillbeabletounderstandandable to perform different characterization techniques used in nanotechnology
3	Understand important characterizationtechniquestoanalyze nanomaterials properties	Studentswillbeabletoperformvarious synthesis techniques to produce nanomaterials.
4	Applicationsofnanotechnology	Students will be able to understand and explainapplicationsofnanotechnologyin different sector of society.

DSE–4(PROJECTORBASICINSTRUMENTATION)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Understand the static and dynamic characteristicsofaninstrumentand Calculate and analyze the measurement error, accuracy, precisionandlimitingerror.	Studentswillbeabletocalculateerror, accuracy measurement etc.

2	Describe the basic electronic instrumentslikemultimeter,CROand signal generators etc.	The students will be able to know the use of basicmeasuringdeviceslikeanalogganddigital multimeter,voltmeter,CRO,signalgenerators etc.
3	Toprovideideaaboutsignalgenerator and analysis instruments	Studentswillbeabletounderstand,explain about signal generator and analysis instruments
4	Toprovideexposuretovarious advanced digital instruments	Students will be able to understand and explaintheprincipleandworkingofdigital instruments

GE–1(MECHANICSANDPROPERTIESOFMATTER,OSCILLATIONANDWAVES, THERMAL PHYSICS, ELECTRICITY AND MAGNETISM AND ELECTRONICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Understandmechanicalpropertiesof matterlikemomentofinertia,elastic constants etc.	Studentswillbeabletounderstandand explainarangeofphysicalconceptslike mechanical properties of matter
2	Understand simple harmonic oscillation,damped,forcedvibration, wave propagation in medium	Students will be able to understand and explainthethermalpropertiesofmatter, waves and oscillations,
3	Understandprinciplesofheattransfer and heat engines	Students will be able to determine the relationshipbetweenelectriccurrentand magnetism
4	. Understand theinterrelationship of electricity and magnetism like electromagneticinductionprinciples; growth and decay of currents in transient circuits; semiconductor junctiondevicesandtheirapplications	Students will be able to understand and explainbasicelectronicdevicesandtheir applications.

GE–2(OPTICS,SPECIALTHEORYOFRELATIVITY,ATOMICPHYSICS,QUANTUM MECHANICS AND NUCLEAR PHYSICS)		
UNIT	**COURSEOBJECTIVE**	**COURSEOUTCOME**
1	Understand optical phenomena like interference,diffraction,polarization, dispersion etc.	Students will be able to understand and explainopticalphenomenaoccurring in naturelikemirage,rainbow,bluecolorsky etc.

Post Graduation in Physics FIR

2	Understand the concepts dealing with structure and properties of atoms and experiments involved to establish the facts about atoms.	Students will be able to understand and explain t the characteristics of atoms and subatomicparticlesandtheycanmaintain safety while dealing with radioactive substances.
3	Understandthequantumnatureof particles, wave functions etc.	Students will be able to understand and explain relativity principles and it may improve their understanding of the phenomena like length contraction, time dilationetc.happeningduetorelative motionbetweenobjectandobserver.
4	Understand the nucleus and its properties, radioactive processes etc.	Students will be able to understand and explain the characteristics of quantum particles and it may help them tounderstand the advanced technologies.

Course Objectives:

Students will be able to:

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PHY101

- Know the physical concepts and familiar with classical mechanics and also its mathematical form.
- Solving problem of different systems using classical mechanics.
- To demonstrate the knowledge and understanding of the following fundamental concepts in:
  - The dynamics of system of particles,
  - Motion of rigid body,
  - Lagrangian and Hamiltonian formulation of mechanics
  - Transformations and Hamilton Jacobi theory
  - Small oscillation problems
- Develop equations of motion using Lagrangian and Hamiltonian formulation for complicated mechanical systems.

Course Outcome:-

- Understand the basic mechanical concepts related to discrete and continuous mechanical systems.
- Describe and understand planar and spatial motion of a rigid body and understand the motion of a mechanical system using Lagrange-Hamilton formalism.
- Demonstrate a working knowledge of classical mechanics and its application to standard problems such as central forces.

PHY102

Mathematical Methods in Physics

Course Objective:-

- It will provide students with basic skills necessary for the application of mathematical methods in physics.
- Introduction of various existing mathematical methods in order to analyses theories, methods and interpretations.

● Develop understanding among the students how to use methods within his/her field of study of research and in the field of scientific knowledge to work independently.

Course Outcomes: -

● Demonstrate the utility and limitations of a variety of powerful calculation techniques and to provide a deeper understanding of the mathematics and useful in theoretical physics.

● Understand elementary ideas in linear algebra, special functions and complex analysis.

● Will be able to apply these to solve problems in classical, statistical and quantum mechanics, electromagnetism as well as solid state physics.

PHY103

Quantum Mechanics-I

Course Objectives:

Students will be able to:

● Study postulates and formalism of quantum mechanics

● Study operator formulation of quantum mechanics

● Study time evolution of a state and operator and apply Schrodinger equation to 1D harmonic oscillator

● Study operator algebra of orbital angular momentum and spin angular momentum operator

● Study motion in spherical symmetric potential and apply Schrodinger equation to solve hydrogen atom

Course Outcomes:-

- State basic postulates of quantum mechanics
- Understand the Hermitian operators, projection operators, unitary operators etc.
- Solve Schrodinger equation of harmonic oscillator problem completely using operator method
- State addition of angular momentum theorems and spin angular momentum statistics

- Solve for the hydrogen atom using Schrodinger equation

PHY 104

Classical Electrodynamics

Course Objectives:

Students will be able to:

- Study the Maxwell's wave equation in different dielectric media and free space.
- Understand vector and scalar potential and their importance in electromagnetics.
- Study electromagnetic energy transport and Poynting vector. Understand Lorentz and
- Coulomb gauge conditions, covariant form of Maxwell's equation.
- Study laws of geometrical optics using Maxwell's equation.
- Study Kramer Kronig relation on reflection and absorption of electromagnetic wave.
- Study and understand propagation of electromagnetic waves in different types of waveguides.
- Study of retarded potential and solving it by Green's Function techniques for different types of charge distributions.
- Study electric, magnetic dipole and quadrupole radiation.
- Study electromagnetic radiation due to moving point charge and accelerated charge.

Course Outcomes:

Students will be able to:

- Demonstrate and analyze Maxwell's wave equation in different media. Derive scalar
- and vector potential in presence of different sources.
- Derive the Poynting theorem.
- Apply Gauge invariance condition to Maxwell's equation. Derive Maxwell's equation in co-variant form.
- Derive covariant form of Maxwell's equations.
- Derive relation between reflection coefficient and absorption coefficient. Calculate
- different modes of electromagnetic waves in waveguides.
- Calculate angular distribution of radiation and power emitted by dipole. Show that
- accelerating charge produce electromagnetic radiation.
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PHY 105

Computational Methods in Physics (Practical Paper)

Course Objectives:

Students will be able to:

- To learn computer programming using Python.
- To solve physics problems through different numerical techniques. Use computer programming for simulation and data analysis.

Course Outcomes:-

Students will be able to:

- Write computer programs using Python.
- Use different numerical methods to solve problems using computer programs.
- Simulate physical systems using Monte Carlo Method.

SECOND SEMESTER

PHY 201

QUANTUM MECHANICS - II

Course Objectives:

Students will be able to:

- Study motion in spherical symmetric potential and apply Schrodinger equation to solve hydrogen atom.
- Understand fine structure of hydrogen atom, Stark effect, Zeeman effect. Understand
- interaction of radiation with matter, selection rules.
- Understand variational principle and its application.

Course Outcomes:

- Solve for the hydrogen atom using Schrodinger equation.
- Explain Stark effect, origin of polarizability and dipole moment, fine structure of hydrogen atom and Zeeman effect.
- Understand the dipole selections rules in various atomic transitions.
- Solve the scattering cross-section for various scattering process such as black sphere scattering, hard sphere scattering and inelastic scattering.
- Apply variational principle to find out the ground state energy of the various physical system.

PHY202

Quantum Mechanics – III

Course Objectives:

Students will be able to:

- Understand the importance of perturbation theory in quantum mechanics.
- Study time independent and time dependent perturbation theory and apply those to various physical problem.
- Understand quantum mechanical description of scattering.

Course Outcomes:

Students will be able to:

- Derive energy and wave function for physical system using time independent perturbation theory.
- Derive transition probability under time dependent perturbation theory.

PHY 203

Course **Condensed Matter Physics - I**

Course Objectives:

Students will be able to:

- Know the diffraction condition in reciprocal space
- Understand the crystal bonding types in solid Understand
- Born Oppenheimer approximation.
- Understand the Normal mode of vibrations.
- Understand the electron-phonon interaction and second quantization. Know
- Different models for electrons in solids.

Course Outcomes:

Students will be able to:

- Understand the diffraction process in crystals.
- Understand the mode of vibrations and Dispersion relation.
- Understand the origin of bands and bandgaps in solids.
- Study different models for electrons in presence of nuclear potential.
- Understanding holes.

C **PHY 204**

ourse Objectives:- ***Advanced Particle Physics-I***

o Understand Isospin, Strangeness and Hypercharge, Lepton and Baryon number.

o Understand CPT theorem.

o Understand Unitary Symmetry and the classification of state, Hadrons and SU (3) multiplets.

o Understand the Feynman diagrams in configuration and momentum space.

Course Outcomes:-

- Understand the meaning and importance of the terms: quark, lepton and boson propagators, Feynman diagrams, quantum numbers, charge, colour, weak charge, flavour, symmetries and conservation laws.
- Demonstrate the Isospin, Strangeness and Hypercharge, Lepton and Baryon number.
- Derive the CPT theorem and their applications.
- Demonstrate the Unitary Symmetry and the classification of state, Hadrons and SU (3) multiplets.
- Derive the Feynman diagrams in configuration and momentum space.

PHY 205

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 To analyze various situations or phenomena associated with modern physics and optics physics using basic principles.

 This course will introduce the student to a broad range of physical phenomena involving optics, and modern physics.

Course Outcomes:

Students will be able to:

 To verify experimentally some of the laws and principles associated with modern physics.

C o u r s e O b j e c t i v e s :

TH IR D SE ME ST ER PH Y 30 1

Advanced Quantum Mechanics

 Understand the importance Covariant form.

 Understand Klein-Gordon equation, Dirac equation in relativistic quantum mechanics.

 Understand Lagrangian and Hamiltonian Formulations, Noether's theorem. Understand

 Quantization of free fields.

Course Outcomes:

Students will have achieved the ability to:

 Explain the relativistic quantum mechanical equations, namely, Klein- Gordon equation and Dirac equation.

 Describe second quantization and related concepts.

PHY 302

Course Objectives: Electronics

- Understand Different type of Amplifiers using Hybrid parameters.
- Understand operational principle, model and analysis of various operational amplifiers.
- Understand operation model and analysis of various oscillators. Understand the working, model and analysis of various digital circuits. Understand model and analysis of radio communication and antenna. Understand working principles of fiber optics.

Course Outcomes:

- Explain frequency response of linear amplifiers, feedback amplifier Explain and design differential amplifier, sum and integrator etc Explain feedback criteria for oscillation, crystal-controlled oscillator, Klystron oscillator, principle of multivibrator
- Explain basic logic operations of NOT, AND, OR, NAND, NOR, XOR and flip-flops
- Explain basic principles of radio communications and antennas
- Explain basic principles optical fibers and electromagnetic wave propagation in optical fiber

PHY 303

Advanced Particle Physics-II

Objectives:

- Introduce students to processes in lowest order.
- To impart knowledge about Radiative Corrections. Students will be
- exposed to different type of interactions.

Course Outcomes:

- The students develop basics to solve some of the problems of nuclear physics and their limitations in nature.

PHY 304

Condensed Matter Physics - II

Course Objectives:

Students will be able to:

- Understand the optical and semiconductor properties of solid. Know the
- properties of semiconductor materials.

- Know the properties of superconductor and high Tc superconductor.

Course Outcomes:

Students will be able to:

- Understanding the interaction of electron and phonon.
- Understanding the optical absorption in metals and insulators.
- Derive the Law of mass action relation for the semiconductor material.
- Understands the Cooper pair and energy gap in Superconductor.
- Describe the Kramers-kronig relation for dielectric materials.

PHY 305

C Electronics Practical

Course Objectives:

- To study basic electronic components.
- To observe characteristics of electronic devices.

Course Outcomes:

- Measure voltage, frequency and phase of any waveform using CRO.
- Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
- Analyze the characteristics of different electronic devices such as diodes, transistors etc., and simple
- circuits like rectifiers, amplifiers, OPAM etc.

FOURTH SEMESTER

PHY 401

C **Basic Nuclear and Particle Physics**

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- The students gather advanced knowledge in Nuclear physics.
- The different nuclear interactions and the corresponding nuclear potentials and its dependence on the couplings are learned.
- The knowledge helps to choose for an Advance course in Nuclear and particle Physics.

Course Outcomes:

- The course gives an understanding of the nucleus at low energy.
- The students develop basics to solve some of the problems of nuclear physics and their limitations in nature.

PHY 402

Statistical Physics

Course Objectives:

- Understand postulates of classical and quantum statistical mechanics.
- Study different formalism of statistical physics such as microstate, macrostate and ensembles.
- Understand the Boltzmann and Gibb's interpretation of entropy. Study Fermi-
- Dirac statistics and Bose-Einstein statistics.
- Understand phase transitions and Ising model to study ferromagnetism.

Course Outcomes:

- State postulates of classical and quantum statistical mechanics. Differentiate
- between microstate and microstate.
- Tell the significance Gibb's paradox and indistinguishability in statistical mechanics.
- Describe Planck's blackbody radiation relation, electronic specific heat in metals and Bose-Einstein condensation.
- Describe thermodynamics of phase transition and formulate the Ising model of phase transitions for ferromagnetism.

Course Objectives:

e **PHY**

: **403**

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III

- Students will be exposed to different type of interactions.

Course outcomes:

- Students will understand in details of different type of interactions

PHY 404 SEMINAR & PROJECT

Course Objective:

1. **To enhance understanding of advanced physics topics:** Students engage with cutting-edge research and developments in physics, which helps deepen their knowledge beyond the foundational undergraduate level.
2. **To develop research skills:** The course aims to equip students with the necessary tools to formulate research questions, design experiments or studies, collect and analyze data, and draw meaningful conclusions.
3. **To promote effective communication:** Students learn to effectively communicate complex scientific ideas, both orally and in writing, to varied audiences, including experts and non-experts in the field.

Further professional collaboration and

Through seminars and collaborative projects, students are encouraged to work with peers, faculty, and possibly even industry professionals, which helps build their professional network.

The course is independent and critical

The course is designed to challenge students to think critically and independently, enabling them to tackle complex problems with innovative solutions.

Professional careers or further academic pursuits:

By the end of the course, students should be well-prepared for entering the workforce as physics professionals or pursuing further

Course Outcome:

1. **Mastery of Subject Matter:** Demonstrate a thorough understanding of selected advanced topics in physics through detailed seminar presentations and comprehensive project work.
2. **Research Competence:** Show the ability to conduct independent research, including problem identification, proposal writing, experimental or theoretical methodology, data analysis, and interpretation.
3. **Communication Skills:** Develop skills to effectively present complex scientific results orally in seminars and in written form through research papers or project reports, suitable for publication in academic journals.
4. **Professional Collaboration:** Exhibit the ability to work collaboratively on projects, showing both leadership and teamwork skills, and engaging effectively with peers and mentors.
5. **Innovative Problem-Solving:** Apply advanced physics concepts and methods to solve complex problems, demonstrating innovation and critical thinking.
6. **Preparedness for Career or Further Study:** Be well-prepared for professional opportunities in the field of physics or for pursuing further academic studies.

PHY 405

Condensed Matter Physics & Particle Physics

(Practical Paper)

Course objectives :

 Aim of Condensed Matter Physics & Particle Physics Lab is to train the students for advanced techniques in Condensed Matter Physics & Particle Physics so that they can investigate various relevant aspects and be confident to handle sophisticated instruments of particle and nuclear physics.

Course Outcomes:

Students will have understanding of:

- How to determine the crystal structure, lattice parameter and crystallite size?
- Optical characterization of solid.
- How to operate a GM counter.
- How to find the absorption coefficient of different materials.
- How to handle nuclear materials and nuclear safely management

PROGRAM OUTCOME

Zoology is one of the most fundamental branch of biology to learn and understand animal diversity to appreciate the variability in relation to their morphology, anatomy and behaviour among different animals. Students will be equipped to learn and know about different human systems, their coordination and control. The B.Sc. Zoology course is premeditated to introduce students to the study of zoology at the organismal and organ function levels. The theoretical part of the program deals with the general principles of classical as well as modern zoology. The program provides the student with an introduction to the recent advances in zoology in the areas of systematic, evolution, reproduction, development, animal diversity, biochemistry, molecular biology, cytology and animal ecology. This course is offered for candidates who are interested in the study of animals and human systems. The minimum time required to complete the course is three years

PO1	**Development of Scientific knowledge and temperament** The programme provides students the knowledge about the most fundamental information about the life and allows them to develop their curiosity, scientific temper and attitude.
PO2	**Environment protection and conservation** To gain basic knowledge about environment conservation, environment protection and environment improvement and to motivate them for the welfare of human and non-human communities.
PO3	**Society betterment and Lifestyle management** Apply the knowledge and understanding of Zoology to one's own and social life. Also gain knowledge of communicable and non communicable diseases to improve awareness about personal and public health.
PO4	**Critical thinking and Cognitive skills** Convey the intricate science information effectively and efficiently, analyze and solve the problems related to animal sciences without relying on assumptions and guesses..
PO5	**Communication Skills, Teamwork and leadership qualities** Students will enhance their communication skills to develop an attitude to work as a team and hone leadership qualities. To create interest among students in the field of zoology through different methods including power point presentation, group discussions, seminars.
PO6	**Development of Practical skill** Perform procedure as per laboratory standards in the area of taxonomy, physiology, ecology, cell biology, genetics, applied Zoology, clinical science etc. Acquire the skills in handling scientific instruments, planning

	and performing in laboratory experiments and drawing logical inferences from the scientific experiments.
PO7	**Research-related skills and Scientific reasoning** Demonstrate analytical skill and proficiency in a range of tools and techniques used in research in science and interdisciplinary programmes.
PO8	**Skills for understanding and learning** To escalate their skills for understanding and learning about some of the economic uses of various fauna through project work and educational tours.
PO9	**Employability and higher Education** Show proficiency in professional, employability and develop soft skills required for higher education and placements. Apart from pursuing for higher studies (master in the subject with specialization in different branches in Zoology), the students can also opt from a variety of related branches of science: Related paramedical fields such as health sciences. Agricultural sciences and Master in Forestry Master in Food technology and Processing Wildlife officers Marine Biologist Professional field such as Poultry, Sericulture, apiculture, Pisciculture, dairy etc
PO10	**Skill development, entrepreneurship and lifelong learning** Students will develop skills, tools and techniques to explore prospective avenues of entrepreneurship in emerging areas of life sciences and pursue lifelong learning. Gain knowledge of small scale industries like sericulture, fish farming, bee keeping, aquaculture, animal husbandry, poultry farm.

COURSE OBJECTIVES AND COURSE OUTCOMES IN UG ZOOLOGY

Course Objectives	Course Outcomes
Core Paper 1: Non-Chordates I: Protista to Pseudocoelomates	
● To understand the basic concepts of lower animals and observe the structure and functions. ● To understand the functioning of life sustaining systems in unicellular protists ● To illustrate and examine the systemic and functional morphology of various group of lower invertebrates. ● To compare and distinguish the general and specific characteristics of reproduction in lower animals. ● To infer and integrate the parasitic and economic importance of invertebrate animals	CO1. Gives understanding on basic taxonomy and systematics of whole animal kingdom and classification of protozoa, porifera, cnidaria, and helminth groups. CO2. Provides deeper understanding about general characteristics of animals including habit and habitat, level of body organisation, body symmetry, morphological, anatomical and physiological features from Protista to pseudocoelomates. CO3. Enables students to understand phylogenetic affinities of ctenophores with respect to other phyla. CO4. Emphasises the significance of coral and coral reefs towards marine ecosystem. CO5. Enlightens students about harmful parasites belonging to different invertebrate phyla such as *P. vivax, E. histolytica, T. solium, A. lumbricoides, W. bancrofti*, associated with human host and their epidemiology, pathology, diagnosis, symptoms, treatment and prophylaxis
Core Paper 2: Principles of Ecology	
● To understand the structure and functions of the ecosystem. ● To explain the relationship between biotic and abiotic factors in an ecosystem. ● To bring awareness about the wildlife conservation strategies. ● Learn about attributes of population and community such as growth patterns, strategies; regulation and interactions. ● To provide the fundamental knowledge on statistics in biology focussing on interpretation of results using descriptive statistical methods and analysis of significance level.	CO1. Provides an insight about the fundamental structure and functions of the ecosystem. CO2. Assessment of the inter-relationship between organisms and between biotic and abiotic factors in an ecosystem. CO3. Provides knowledge about synecology reflecting its attributes along with its regulation and various kinds of population interaction. CO4. Enables students to know about community ecology, focusing on its characteristics and different indices. CO5. Provides students a practical hands-on training about biological data handling, sampling techniques, and analysis of the data by using different statistical methods.

Core Paper 3: Non-Chordates II: Coelomates	
• To obtain the knowledge of the taxonomical and characteristics of higher non chordates i.e coelemetes • To understand the morphological and anatomical features of selected coelomate invertebrates. • To understand the evolution of different organ system and their functions in lower invertebrates from Annelida to echinoderms. • To get knowledge about the evolutionary significance of characteristic features specific to the phylum • To study about the metamorphosis and social life in insects	CO1. Learning about classification of coelomate invertebrates and the structure, function alongwith biology of these taxonomic categories as well. CO2. Understanding the functioning of sophisticated characteristic features such as excretion, vision respiration, metamorphosis, torsion and water vascular system in the higher invertebrates. CO3. Enables students to know about the social life and distribution of work in bees and termite colonies CO4. Learning the significance of coelomates in evolution of chordates characters particularly of echinoderms
Core Paper 4: Cell Biology	
• To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles. • To understand how these cellular components are used to generate and utilize energy in cells.	CO1. Enables students to understand and recall the basic structure, origin and development of cell organelles. CO2. Allows students to study prokaryotic cell and eukaryotic cell and all the vital cellular organelles such as cytoskeleton, mitochondria, peroxisomes, nucleus, Golgi complex, lysosomes etc. along with their functions.

● To enhance the knowledge on cell organelles and their role in metabolic activities. ● To understand the cellular components underlying mitotic cell division.	CO3. Explain the role of cells and cell organelles in various biological processes CO4. Provides detailed knowledge about the mechanism of cell division and signal transduction among cells. CO5. Provides a hands-on training to study stages of cell division by taking live models
Core Paper 5: Diversity and distribution of chordates	
●To understand the structures and distinct features of phylum Chordata. ●To understand and able to distinguish the characteristic features of each subphylum and class of Chordata. ● To understand the evolution of vertebrates from Pisces to Mammalia. ● To know about the origin, adaptations and affinities of different classes of vertebrates.	CO1. Understanding the origin and evolution of chordates features in protochordates CO2. Enable the students to classify, identify and learn about distinct features of different subphylum belonging to phylum Chordata. CO3. Explain and relate the origin, structural organization and evolutionary aspects of vertebrates at class level CO4. Allows students to analyse, compare and understand the development of features adaptive to migration of life from aquatic to terrestrial mode in vertebrates focussing on origin of Tetrapoda. CO5. Provides a correlation between the different modes of life and parental care among vertebrates. CO6. Enable students to distinguish between poisonous and non-poisonous snakes and learn about poison apparatus and biting mechanism in snakes. CO7. Provides knowledge about the mechanism of flight adaptation in Birds and their migration patterns which would be helpful for ornithological studies. CO8. Summarise the morphology and ecological adaptations in vertebrates and corelating it to their geographical distributions in different realms of world
Core Paper 6: Physiology: Control and coordinating systems	
● To get knowledge about the anatomy and physiology of different tissue types ● To understand the structure and functions of muscular and nervous system in human body ● To understand physiology of human vison and hearing	CO1. Provides classification, structural identification, location, and functions of different tissues in human. CO2. Understanding the mechanism of bone and cartilage formation and bone resorption in human.

• Gain insights on anatomical and physiological aspects of human reproductive system • To aware students on different contraceptive methods • To understand the hormonal regulation of different physiological activities in body.	CO3. Histological study of muscular system and physiological mechanism of muscle contraction in human. CO4. Understanding the structure of nervous system and physiological mechanism of nerve impulse transmission in human. CO5. Learning about physiology of reflex action, hearing and vision CO6. Provides knowledge about the hypothalamo and hypapophysial axis and understand the different endocrine glands and their disorders in humans. CO7. Learning about mechanism of action of different hormones with their associated functions CO8. Aware about the functioning of reproductive system in humans alongwith learning about conception and contraception CO9. Provide hands-on training on tissue processing and staining for histological analyses using microtome .
Core Paper 7: Fundamentals of Biochemistry	
• To attain knowledge of important biomolecules such as carbohydrates, lipids, amino acids, proteins and enzymes. • To provide an introduction to the structure of biomolecules and physiological significance • To learn about the immunoglobulins and their significance as antigenic determinants • To understand the role of enzymes in metabolism and their regulation • To train students for experimental determination of different biochemical parameters.	CO1. Understanding the students about the importance and scope of biochemistry. CO2. Learning about the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids. CO3. Provides knowledge about the structure and function of immunoglobulins as part of our immune system. CO4. Understand the concept of enzyme, its mechanism of action and regulation. CO5. Hands on training on biochemical tests for qualitative determination of amino acids, carbohydrates, proteins and nucleic acids. CO6. Hands on training on measurement of enzyme activity and its kinetics CO7. Hands on training on protein separation using discontinuous electrophoretic system such as SDS-PAGE
Core Paper 8: Comparative Anatomy of vertebrates	

• To gain a knowledge base for understanding vertebrate anatomy levels of organization and related functions. • To understand all the life sustainable systems like integumentary system, skeletal system, respiratory system, circulatory system, digestive system, urinogenital system, neural coordination etc. of vertebrates. • To understand the evolution of these vital physiological systems with increase in the complexity of structure and function in vertebrates at class level. • To give an overview of the intricate life processes and adaptive radiations in vertebrates.	CO1. Study of structure and function of integuments and its derivatives in vertebrates. CO2. Learning about skeletal framework and articulation of jaws with skull in vertebrates. *CO3.* Understanding the hierarchical complexity in digestive and respiratory system in vertebrates CO4. Provides knowledge about fundamentals of circulatory system and evolution of four chambered heart from two chambered heart and aortic arches as an adaptive feature to terrestrial mode of life in vertebrates. CO5. Carry out a comparative study of urinogenital system in vertebrates. CO6. Learning about evolution of brain in vertebrates with emphasis on sensory receptors in mammals.
Core Paper 9: Physiology: Life sustaining systems	
• To provide an insight into the structure and function of organ systems in humans and their involvement in body metabolism towards maintenance of homeostasis. • To understand the physiology of digestion in humans with emphasis on absorption of different nutrients, minerals and vitamins. • To learn about the mechanism of respiration and pulmonary ventilation • To carry out a comprehensive study on the functioning of kidney in concordance with circulatory system to maintain body homeostasis • To train students on measurement and interpretation of experimental data for physiological parameters using various tools and techniques	CO1. Explain the histology and physiology of different parts of digestive system along with understanding the mechanical, chemical digestion and absorption of different nutrients in the GI tract CO2. Study the structural organisation of respiratory tract and mechanism of pulmonary respiration with emphasis on mechanism of gaseous exchange in between lungs and tissues via blood. CO3. Learning about the mechanism of urine formation and the maintenance of water and acid-base balance in human body. CO4. Understanding the formation, composition and function of blood. CO5. Provides knowledge about the structural organisation of mammalian heart alongwith study of cardiac cycle CO6. Provides a hands-on training on examination of blood grouping, haemoglobin concentration, haematocrit, and blood pressure.
Core Paper 10: Biochemistry of metabolic processes	
• To provide students with knowledge in the biochemical basis of metabolic processes occurring at cellular level.	CO1. Enables the student to understand the basic concepts of metabolism emphasising on

• Enable the students to understand the functions of different biomolecules with context to molecular functions and biological processes. • To assess the importance and coordination of biomolecules in normal body function. • To understand the role of enzymes in metabolism • To learn fundamental approaches for experimentally investigating biochemical parameters.	interactions of different metabolic processes to carry out a biological function. CO2. Provide knowledge about significance of ATP as energy currency, reducing equivalents and cofactors in different metabolic processes. CO3. Learning about energy generation from major nutrient source i.e glucose through different catabolic processes and its storage in form of glycogen. CO4. Understanding the catabolic degradation of fatty acids and amino acids alongwith learning about urea cycle required to eliminate toxic ammonia from the body. CO5. Provides on hands-on training on quantitative determination of protein and biochemical parameters in blood
Core Paper 11: Molecular Biology	
• To understand fundamentals of genetic material and mechanism underlying gene expression. • To learn about the basic structure of nucleic acids and the molecular basis of central dogma. in prokaryotes and eukaryotes. • To understand application of molecular biology in genetic engineering. • To understand application of gene silencing in agriculture, animal husbandry and medicine • To give students competent lab skills for biochemical, molecular biology and microbiology experiments.	CO1. Provides a knowledge about structural organisation and salient feature of DNA and RNA. CO2. Understanding the principle of molecular mechanism of DNA replication and repair in prokaryotes and eukaryotes. CO3. Detailed study of genetic code present as a DNA template in the genetic material CO4. Learning about the molecular mechanism of transcription and translation in prokaryotes and eukaryotes. CO5. Learning about inhibitors of protein synthesis such as antibiotics and their mode of action. CO6. Understanding the significance of post-translational modifications of proteins in determining their varied functions in eukaryotes. CO7. Detailed description of gene expression regulation focusing on operon, regulatory elements and mechanism of gene silencing. CO8. Hands- on training on quantitative determination of nucleic acids (DNA and RNA) alongwith basic microbial techniques
Core Paper 12: Principles of genetics	

• To understand the molecular mechanisms by which genetic material controls the character and growth of organisms. • Provide an insight into chromosomal basis of inheritance (Mendelian classical genetics) and extra chromosomal inheritance • To know the causes and effects of mutations with emphasis on environmental mutagens. • To understand the chromosomal mechanisms of sex determination in human • To understand genetic and chromosomal anomalies in humans. • To learn modes of genetic recombination in bacteria and viruses and its application in genetic engineering	CO1. Learning Mendelian postulates and principle of inheritance. CO2. Understanding the types of allelic and non-allelic gene interaction in different organisms. CO3. Provides a knowledge on cytological basis of linkage and crossing-over and its role in evolution. CO4. Understanding the criteria of sex determination in different organisms such as by sex chromosomes in *Drosophila* and Man; and by maternal cytoplasmic determinants in yeast, *Paramecium*, Snail. CO5. Learning about recombination strategies in bacteria and viruses. CO6. Explains the fundamentals of genes mutations: their sources (mutagens), effects and determination strategies. CO7. Provides an insight about Transposons (Jumping genes) in humans, bacteria and Drosophila which can create or reverse mutations altering the cell's genetic identity and genome size. CO8. Hands on training on preparation of linkage maps, human karyotype and pedigree analysis to understand inheritance of traits and genetic disorders.
Core Paper 13: Developmental Biology	
• Aims to understand and correlate the significance of cellular processes in embryonic development showing how a single cell becomes an organized grouping of cells which is then programmed at specific times to become specialized for certain tasks • To aware students about production of gametes and fertilization patterns • To help students to distinguish between the different types of developmental mechanisms in various organisms particularly in frogs, birds and humans	CO1. Provides an insight into the types of cellular processes involved in embryonic development that contribute to morphogenesis and organogenesis CO2. Enables the students to relate the factors that contribute to the developmental process, construct fate maps and illustrate the steps in. CO3. Understanding the significance of morphogens, inducers and organisers in embryonic development. CO4. Learning about the process of gametogenesis, fertilization and prevention of polyspermy CO5. Appraise the species-based differences of developmental mechanisms such as cleavage,

• To learn about metamorphosis, regeneration, ageing, and teratogenesis.	blastulation and gastrulation in frogs and birds based on types of eggs. CO6. Understanding the physiology of metamorphosis and regeneration in organisms CO7. Aware the students about the process of implantation of embryo with development of placenta in humans alongwith learning about ageing and teratogenesis. CO8. Enlightens students about techniques related to conception and embryonic development such as In-vitro fertilization (IVF), stem cell research and amniocentesis which has could be used as career option in future. CO9. Hands on training on culture of animal models used in developmental studies such as Drosophila and chick embryo.
Core Paper 14: Evolutionary Biology	
• To have an insight about the origin of life on earth and the diversification and adaptation of life forms over time. • This course would help to understand the important processes, principles, and concepts on evolution. • To examine evolution of life through different evidences such as fossil records and connecting links. • To understand the population genetics with application of Hardy-Winberg Law. • To understand the concept of species, speciation, and different isolating mechanisms contributing to it. • To apply the knowledge of human evolutionary history to understand origin and evolution of man from primates • To explain the significance of phylogenetic studies in the wider context of biodiversity and conservation.	CO1. Emphasizes on the origin of life and the mechanisms associated with it, furthermore it provides knowledge about the evolutionary processes of life thorough various evidences such as fossil records, connecting links etc. CO2. Provides adequate information on the various concepts of evolution such as Lamarckism, Neo Lamarckism, Darwinism, Neutral Theory of Molecular Evolution alongwith explaining the significance of extinction on the evolution. CO3. Enlightens students about population genetics applying the principles of Hardy-Winberg Law alongwith emphasising on different processes of evolutionary changes such as natural selection, genetic drift, migration and mutation. CO4. Understanding the concepts of speciation, isolating mechanisms, micro-evolution and macro-evolution. CO5. Educates about human origin and its evolution in great length with respect to Body posture, brain size, capacity and pattern of skull structure, social interaction. CO6. Hands- on training on construction of phylogenetic tree and multiple sequence

	alignment with the help of Bioinformatics tools and their interpretation.

Discipline Specific Elective 1: Animal Behaviour and Chronobiology	
• To learn the origin and development of animal behaviour and to understand the influence of genetics, environment on animal behaviours. • To understand the biological properties of animal behaviour, with an evolutionary and ecological emphasis. • To Compare innate and learned behaviour and differentiate between various mating system. • To impart the knowledge about visual and auditory communication; courtship, mate choice, and mating systems; social behaviour and social systems; and animal personality. • Understand the concept of biological clock, circadian rhythm and regulation of seasonal reproduction of vertebrates.	CO1. Provides an insight about the origin and development of animal behaviour alongwith learning about the influence of genetics, environment on animal behaviours. CO2. Enlightens the importance of Ethology: study of Behaviour as discipline of science CO3. Understanding the concepts of stereotyped behaviour, individual behaviour patterns, associative learning, conditioning, habituation and imprinting alongwith carrying out a comparative study of innate vs learned behaviour CO4. Gain knowledge about concept of society and social behaviour emphasizing on foraging behaviour, use of dance for communication and functioning of insect society taking honey bee as example. CO5. Learning about sexual behaviour, courtship, mate choice, male rivalry and mating systems in animals with distinct sexual dimorphism. CO6. Enlightens the students about chronobiology with discussions on biological oscillations, biological clocks, biological rhythms (circadian and circannual), synchronization and masking, zeitgebers. CO7. Understanding the concept of photoperiod and role of melatonin in regulation of seasonal reproduction of vertebrates CO8. Develop skills to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild through field trips.

Discipline Specific Elective 2: Immunology	
• To understand the fundamentals of immunology in protection against disease and also the key principles of antigen- antibody reaction in the immune system. • To learn about the fundamentals of immune system focusing on the molecular, cellular and organ level elements and hierarchy of immune response. • To study the principles behind recognition of "self" and "non-self antigens"by immune cells to mediate appropriate immune response. • To aware the students about various immune dysfunction diseases such as Rheumatoid Arthritis and AIDS as well as diseases with exaggerated or inappropriate immunologic responses i.e Hypersensitivity. • To enlighten students about various types of vaccines and advances in vaccines production • To demonstrate the preparation of smears to study immune cells alongwith immunoassays (ELISA) which has diagnostic significance • To promote critical thinking and provide students with knowledge on how the immune system works building on their previous knowledge from biochemistry, genetics and cellular biology.	CO1. Gain knowledge about the components of immune system involving specific cells and organs. CO2. Provides a comparative study of natural vs artificial immunity; cell-mediated vs humoral immunity; and passive vs active immunity CO3. Evaluation of the antigenic and immunogenic property of any invasive foreign substance. CO4. Understanding the role of antigen-antibody reaction by B cells; and antigen processing and presentation by T cells, in mediating an immune response. CO5. Understanding the mechanism for discrimination of self from nonself antigens by MHC molecules and T-cells CO6. Learning about aetiology behind immune dysfunction diseases such as autoimmune diseases, Rheumatoid Arthritis and AIDS, as well as diseases with exaggerated or inappropriate immunologic responses i.e Hypersensitivity. CO7. Evaluation of cytokines and complement system in mediating an immune response alongwith providing an insight about their potential role as biomarkers. CO8. Study of clinical application of antigen-antibody interaction emphasising the development and advancement of vaccine production CO9. Enlightens the students about the basic principle and application of immunoassays such as ELISA, RIA in diagnostics alongwith hands-on demonstration.
Discipline Specific Elective 3: Fish and Fisheries	
• To understand the taxonomic and systematic hierarchy of native and exotic fishes with economic importance. • To learn about anatomical, structural, physiological and other characteristic features of fishes. • To aware students about inland and marine fisheries emphasizing on the	CO1. Provides an insight about the taxonomic and systematic hierarchy of native and exotic fishes with economic importance. CO2. Understanding the anatomical, structural, physiological features of fishes alongwith study of their social behaviour such as schooling and migration

impact of environmental factors and anthropogenic activity on fisheries. ● To enlighten students about of sustainable aquaculture and management of fish hatcheries ● To educate students about preparation and maintenance of indoor aquariums for rearing of ornamental fishes with economic importance ● To learn about pathology of fish diseases emphasizing on disease control methods used in farming ● To understand application of genetic engineering in development of transgenic fish. ● To assess post-harvest processing of fish and large-scale industrial utilisation of fish byproduct**.**	CO3. Learning about the pattern of different scale structure and its use in determination of age of the fish. CO4. Create awareness about distinction between inland and marine fishery alongwith detailing about fishery laws and regulations CO5. Study the different types of crafts and gears used for fishing CO6. Evaluate the depletion of fisheries resources due to environmental and anthropogenic interference. CO7. Understanding the concept of sustainable culture, extensive and intensive culture, poly culture, composite fish culture emphasizing on management of fish hatcheries CO8. Aware the students about brood stock management, induced breeding to enhance fish productivity. CO9. Learning about various types of fish diseases which can adversely impact on fish production, and their preventive and treatment measures. CO10. Understanding the post-harvest processing of fish and large-scale industrial utilisation of fish byproduct. CO11. Learning about preparation and maintenance of indoor aquariums for rearing of ornamental fishes with economic importance CO12. Enlightening students about application of genetic engineering in development of transgenic fish. CO13. Skill based course which will empower the students for fishery practices, sustainable aquaculture with hatchery construction as well as culture of ornamental fishes in indoor aquariums, encouraging them for entrepreneurship and self-employment.
Discipline Specific Elective 4: Project Work	
● To apply the gained knowledge in the theoretical foundations and laboratory techniques, while doing their own research and coming up with practical solutions to the concept they are trying	CO1. Project work essentially accentuates cognitive abilities of student's while giving them practical experience. CO2. Sets the foundation for laboratory research, data analysis and presentation.

to learn or the problem that they are trying to solve. ● To inculcate, promote, and uphold the principles of learning through experience and experimentation. ● To facilitate bench work skills in students ● To understands planning and execution offield/experimental works. ● To educate the students about time management skills. ● To enable students to represent their research findings in proper manner alongwith data interpretation and analysis for inferring conclusive results.	CO3. Enable the students with preliminary knowledge on designing experiments in laboratory conditions. CO4. Students learn to hypothesize the project designs and are trained to analyze the experimental results. CO5. The usefulness of project work is that it enables the student to be methodical in his approach to solving the research problem. CO6. Project work enables the student to be more organised with his work and do things in an orderly and timely manner. CO7. Acquiring appropriate project writing skill will enable the students to represent their research findings in proper manner alongwith data interpretation and analysis for inferring conclusive results. CO8. Each student has to undertake a project work under the guidance of a teacher and submit the project report in the form of a dissertation. There will also be a PowerPoint presentation of the project work before an external examiner CO9. Skills acquired by student while pursuing project work will be useful for undertake research for higher studies in any aspect of animal physiology in future.
General Elective 2: Animal Diversity	
● To observe the organization, functional morphology and diversity of representative invertebrates and chordates. ● To describe the characteristics of animal diversity and identify the key features that classify animals into phyla ● To study general characteristic features specific to each taxonomic group. ● To acquire knowledge regarding differences between taxa with examples. ● To observe and identify the structure, organization and life history of parasites of man. ● To learn about evolution of tetrapoda, reptiles, birds and mammals.	CO1. Understanding the systematic and taxonomic hierarchical classification of animals ranging from protists to chordates. CO2. Create awareness about life cycle and adaptations in important parasites such as *Plasmodium, Taenia* and other nemathelminths. CO3. Learning about important characteristic features apart from studying general characters specific to each taxonomic group CO4. Understanding the complexity and evolution of acoelomates, pseudocoelomate and coelomate, later again diversifying into protostome and deuterostome. CO5. Provides an insight about pearl formation which has economic importance

	CO6. Learning about origin of Tetrapoda, reptiles, birds and mammals
General Elective 4: Food, nutrition and health	
● To understand concept of balanced diet and nutritional need for healthy life in various age group focusing on the consequences of malnutrition and the deficiency diseases ● To learn about nutritional benefits of dietary biomolecules such as carbohydrates, lipids and proteins. ● To understand dietary source and importance of vitamins, and minerals towards different biological functions. ● To create awareness about social health problems and life style diseases and their prevention and treatment. ● To educate about food and water hygiene emphasising on various diseases associated with contamination of food and water. ● To provide hands on training for detection of adulteration and estimation of nutritional value of food items	CO1. Understanding concept of balanced diet and varied nutritional need among age groups such as infants, children, pregnant and nursing mothers, adolescents, and elderly. CO2. Learning about definition, classification, dietary source and nutritional benefits of dietary biomolecules such as carbohydrates, lipids and proteins. CO3. Understanding the role of vitamins and minerals in carrying out different physiological functions in human. CO4. Provides an insight about concept of health and major nutritional deficiency disorders. CO5. Create awareness about the prevention of various nutritional disorders through government programmes. CO6. Educating about various life style related diseases such as Diabetes, obesity, hypertension along with health problems associated with smoking, alcoholism, drug abuse, and AIDS. CO7. Understanding importance of food and water hygiene focussing on various food and water borne infections such as cholera, typhoid, hepatitis, polio, amoebiasis and their preventions. CO8. Undertake computer aided diet analysis and nutrition counselling of different age groups. CO9. Study of nutrition labelling of commercially available foods. CO10. Hands-on training for detection of adulteration in food items such as ghee, sugar, tea leaves and turmeric alongwith estimation of lactose and calcium in milk .