



## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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**PROGRAMME AND COURSE OUTCOMES FOR ALL  
THE PROGRAMMES OFFERED BY THE INSTITUTION**





# DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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## Department of Biotechnology

### B.Sc. (Biotechnology)

#### **PROGRAMME OUTCOMES (POs)**

This program helps to demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology research, Biotechnology Industry, Pharma industry, Medical or hospital related organizations, and Academia. It also helps to demonstrate skills to use modern analytical tools/ software/ equipment and analyze and solve problems in various courses of biotechnology. Execute their professional roles in society as biotechnology professionals, employers and employees in various industries, researchers and educators. This program designs, performs experiments, analyses and interprets data for investigating complex problems in biotechnology and related fields. It demonstrates learning skills to work as a team in a multidisciplinary environment and design and develop sustainable solutions to major biological problems by applying appropriate biotechnology tools. Develop skills, attitude and values required for self-directed, lifelong learning and professional development. It aids in acquiring knowledge and understanding of norms and ethics in the field of biotechnology.

#### **B.Sc. First Year: Semester I**

**COURSE CODE: B100101T**

**COURSE TITLE: Cell Biology and Genetics**

This course introduces the principles of cell biology and genetics. After completion of this course students will be able to learn different areas of cell biology including the structure and functions of the cell, its organelles such as mitochondria, nucleus etc. Help them to understand how genetic information is transmitted in organisms. Make them understand the role of cytoskeleton and its remodeling including the diseases associated with improper remodeling. Help to learn how the synthesized proteins are transported to different organelles and understand the regulation of cell cycle, programmed cell death and Cancer. Help to learn



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different cell biology techniques like karyotyping, chromosome banding, FISH, FACS, centrifugation and microscopy.

**COURSE CODE: B100102P**

**COURSE TITLE: Cell Biology and Genetics Lab**

After completion of this course, students will be able to-

Learn, understand and develop skill and hands on training in basics of cell biology and genetics. The students will be able to differentiate between plant and animal cells. They will analyze different stages of mitosis and meiosis.

**B.Sc. First Year: Semester II**

**COURSE CODE: B100201T**

**COURSE TITLE: Molecular Biology and Genetic Engineering**

The students will be able to learn and understand the important discoveries that are made in the field of molecular biology. They will learn key molecular events that occur during the DNA replication, transcription, translation and regulation of gene concepts. The students will gain knowledge on the foundation of genetic engineering and their applications in biological research as well as in biotechnology industries.

They will understand gene concepts, plasmids, and a wide range of techniques, especially modern molecular tools in diagnosis.

The students will be acquainted with various techniques of genetic engineering and their applications in biological research, diagnostics as well as in biotechnology industries.

**COURSE CODE: B100202P**

**COURSE TITLE: Molecular Biology and Genetic Engineering Lab**

After completion of the course, the student shall be able to -

- Prepare different bacterial growth media.
- Understand principles and methods of competent cell preparation, restriction digestion,



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- Gene ligation, gene cloning, and transformation i. e gene manipulation.
- Understand the method of agarose electrophoresis for plasmid and genomic DNA separation
- Understand the method of blotting and PCR.

### **B.Sc. Second Year: Semester III**

**COURSE CODE: B100301T**

**COURSE TITLE: Biochemistry and Biochemical tools**

After successful completion of the course, students will be able to understand the significance of Biochemistry and learn the chemistry of carbohydrates, lipids, proteins and amino acids.

The students will understand the basics of enzymes & the metabolism of carbohydrate and proteins, know the chemical structure of nucleotides including their components, and describe primary, secondary structure of DNA and RNA.

**COURSE CODE: B100302P**

**COURSE TITLE: Biochemistry Lab**

Students will get practical exposure to commonly used biochemical techniques and also they will become familiar with instruments like calorimeters, pH meter etc. The practical will introduce the primary steps in biomolecules (focus on proteins) purification which includes various methods in isolation and quantitation of proteins. The students will learn how to separate proteins from a heterogeneous mixture. They will learn to apply important chromatographic techniques to purify biomolecules and will be familiarized with the working Principles of electrophoresis and UV/Vis and fluorescence, spectroscopic techniques and application of the knowledge to get basic structural information.



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### **B.Sc. Second Year: Semester IV**

**COURSE CODE: B100401T**

**COURSE TITLE: Microbiology & Immunology**

On the successful completion of the course, students will be able to pioneer in microbiology and their contributions. The students will understand the physical and chemical method of sterilization and analyze the media composition and grow the desired microbe and understand the methods of cultivation of microorganisms and understand different staining methods. They will understand and differentiate the different types of microbes. And the students will understand the principles of immunology. They will learn about structural features of components of the immune system as well as their function and development of the immune system and mechanisms by which our body elicits immune response.

The course will predict the nature of immune response that develops against bacterial, viral or parasitic infection, and prove it by designing new experiments.

Understand different tools and techniques of immunology and understand the biology of different vaccines against infectious agents.

**COURSE CODE: B100402P**

**COURSE TITLE: Microbiology and Immunology Lab**

After completion of the course students will be able to -

- Understand methods of cleaning and sterilization of plastic wares and glass wares.
- Understand and perform pure culture techniques which includes, pour plate and spread plate.
- Understand the preparation and use of differential, selective and special media.
- Understand and identify the morphology of cells of the immune system.
- Understand the basic concepts of blood grouping.
- Understand antigen antibody interactions and thus quantitate the presence of antigen and or antibodies in biological samples.



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### **B.Sc. Third Year: Semester V**

**COURSE CODE: B100501T**

**COURSE TITLE: Biostatistics and Bioinformatics**

After completion of the course, students will be able to learn the need of statistical approach, identify the different axiomatic approach. They will learn to study the variability of observation. The students will know effective use of Office Package-Word, Excel, PPT and Publisher etc. and understand simple calculation using excel.

The students will understand the basic theories and practicals of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts. They will critically analyze and interpret results of their studies with the help of bioinformatics and bio-statistical tools.

**COURSE CODE: B100502T**

**COURSE TITLE: Animal and Plant Biotechnology**

After completion of this course, students will be able to understand the principles, practices and application of animal biotechnology in - Transgenesis, Tissue Engineering, and biopharmaceuticals. They will understand the principles, practices and applications of plant biotechnology, transgenic plant generation, plant tissue culture, plant genomics, and genetic transformation. They will understand applications of stem cells and tissue engineering. The students will learn different gene delivery methods to deliver foreign genes in plants and animals and know about different products of transgenic animals, plants and microbes.

**COURSE CODE: B100503P**

**COURSE TITLE: Bioinformatics, Biostatistics Tissue culture Lab**

The students will be able to apply basic bioinformatics tools for the studies and research in other areas of their biotechnology and microbiology programs, such as finding gene/protein homologs, designing primers, identifying mutations, etc.



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Cleaning, sterilization of laboratory, plastic and glass wares and preparing different types of culture media for animal and plant cell culture and understanding and solving the problems in the area of animal and plant Biotechnology.

### **B.Sc. Third Year: Semester VI**

**COURSE CODE: B100601T**

**COURSE TITLE: Industrial and Environmental Biotechnology**

After successful completion of the course, students will be able to understand the problems in isolation, strain improvement and growth of microorganisms in industrial processes and isolate and improve the industrially important microorganisms. They will understand design and types of fermenters and operation of fermenters. They will learn the fundamentals of Environmental Biotechnology. They will understand the importance of a clean (pollution free) environment and understand biotechnological solutions to address environmental issues including pollution, mineral resource winning, renewable energy and water recycling and understand the regulation of bioethics and policies of IPR and entrepreneurship.

**COURSE CODE: B100602T**

**COURSE TITLE: Food Biotechnology**

After successful completion of the course, students will be able to understand the history and evolution of food technology and processing and understand the importance of microorganisms in food preservation. They will learn various food processing and preservation technologies.

**COURSE CODE: B100603P**

**COURSE TITLE: Industrial and Environmental Biotechnology Lab**

After completion of this course, students will be able to-

- Understand various methods of screening of industrially important microorganisms from different sources.
- Understand the working of small scale fermenters and also determine the aeration



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efficiency of the fermenter and understand the technique of immobilization of cells like yeast and E.coli.

### M.Sc. (BIOTECHNOLOGY)

#### PROGRAMME OUTCOMES (POs)

This program explores the knowledge for the changes occurring in living cells and demonstrates the interdisciplinary skills in the fields of biochemistry, cell and molecular biology, bioprocess engineering, plant biotechnology, genetic engineering, microbiology and bioinformatics. The program focuses on techniques used in industry for production of microbial/plant / Animal products thus it enables development of an understanding of an applied aspect of microbes/plants/animals in industry.

It develops in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology Industry, Pharma industry, Medical or hospital related organizations, Regulatory Agencies, & Academia.

It trains the students in all the fundamentals of the subject of Biotechnology,

Progressively giving way to all essentials of the subject with good practical training and exposure to most modern concepts. Develop an ability to solve, analyze and interpret data generated from experiments done in project work or practical courses. It demonstrates skills to use modern analytical tools/software/ equipment's and analyze and solve problems in various courses of biotechnology.

The curriculum carries multiple options in terms of electives for incorporating innovative ideas generated in this field. It provides ample opportunity for the students to gain sufficient practical knowledge in the subject with properly designed experiments. It adopts code of ethics in professional and social context and demonstrates exemplary professional, ethical and legal behaviors in decision making. It explores new areas of research in all the branches of biotechnology in addition to interdisciplinary fields.

It helps the students to mold themselves as competent enough in an international pursuit of





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knowledge by providing written and oral communication skills to communicate effectively in healthcare, industry, academia and research.

The interdisciplinary nature of the subject is to be incorporated to have option for employment and higher studies also develop skills, attitude and values required for self-directed, lifelong learning and professional development.

### **COURSE OUTCOMES (COs)**

#### **M.Sc. First Year: Semester I**

**COURSE CODE: L030701T**

**COURSE TITLE: Cell and Developmental Biology**

The student can understand how the cell is equipped with machineries to conduct activities as the basic structural and functional unit of life. They will learn the structural features of cell organelles/machineries and the functional mechanisms of cellular phenomena. They will know the fundamental principles of heredity and deviations from Mendelian behavior.

**COURSE CODE: L030702T**

**COURSE TITLE: General Biochemistry**

The student is exposed to the biochemical composition of the cell, its structure and types of nutrient components. The students will learn the major metabolic pathways and their significance and the coordination of metabolic pathways.

**COURSE CODE: L030703T**

**COURSE TITLE: Bioanalytical Techniques**

The student gets awareness in the techniques used in the visualization of cellular components and macromolecules. They will learn the analytical techniques used in detection and quantification of biological compounds and the separation techniques used in biology. They



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will learn the application of statistical principles in biological studies, the research methodology and documentation.

**COURSE CODE: L030704T**

**COURSE TITLE: General Microbiology**

The students will get an exposure in microbial grouping and its taxonomic significance. They will gain knowledge on the cultivation and identification of microorganisms. The organization of Bacterial Cell and the maintenance and preservation of bacterial cultures. The students will learn the general characteristics of Archae bacteria and their phylogenetic overview and the overview of Bacterial Diversity: Morphology, Metabolism, Ecological Significance and Economic Importance

### **M.Sc. First Year: Semester II**

**COURSE CODE: L030801T**

**COURSE TITLE: Molecular Biology and Genetics**

The student gets a comprehensive knowledge of the structural and functional organization of the genome. They will learn the molecular phenomena of DNA copying and transmission of information. Acquire knowledge about the regulation of gene function and associated phenomena and the fundamental principles of heredity and deviations from Mendelian behavior. The students will learn about the effect of mutations and mutational analysis and principles of behavioral and population genetics.

**COURSE CODE: L030802T**

**COURSE TITLE: Intermediary Metabolism**

The students will learn the characteristics of enzymes as biological catalysts, enzyme kinetics, enzyme classification and the role of nucleic acids in synthesis of macromolecules, particularly proteins and enzymes. They will study the structure and physio-chemical properties of



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carbohydrates from monosaccharide to polysaccharides. They will also learn the difference between the water soluble and fat- soluble vitamins and their key role in the metabolism as coenzymes. They will learn the rate of reactions and order of reactions, and inhibitions and their kinetics. This course teaches the basic anatomy and physiology of the human body. The students are taught the functioning aspects of the human body at molecular level. At the end of this course the students will be able to appreciate the anatomical and physiological aspects of the human body.

**COURSE CODE: L030803T**

**COURSE TITLE: Plant Biotechnology and Tissue Culture**

Students get familiarized with the fundamental requirements and design of the lab to carry out plant Tissue culture experiments. They learn the different approaches and techniques involved in creating recombinant plant. They learn the applications and demerits of genetic modification in plants. This course introduces the students to explore entrepreneurial avenues in this field.

**COURSE CODE: L030804T**

**COURSE TITLE: Enzymology**

It helps the students to learn the significant features of the biochemical catalysts and the methodology involved in assessing the enzyme activity and mechanism of enzyme action. It illustrates the enzyme catalysis, kinetics and regulatory aspects.

### **M.Sc. Second Year: Semester III**

**COURSE CODE: L030901T**

**COURSE TITLE: Cellular and Molecular Immunology**

The students have knowledge of the cells and organs associated with the immune system, the details of Immune System Functioning, analytical techniques based on Immunological Reactions, and the after effects of defects in the immune system. This course provides you with knowledge and understanding of immunology and the way it is applied in diagnostic and



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therapeutic techniques and research.

**COURSE CODE: L030902T**

**COURSE TITLE: Principle and Application of Genetic Engineering**

This course will provide students with recent knowledge of genetic engineering. At the end of the course, a successful student will be able to understand and explain the concept of genetic engineering including the techniques, applications and limitations. It helps them demonstrate the ability to design recombinant molecules and apply information extracted from a variety of sources including journal articles, technical bulletins, product manuals, and drug information sheet to solve problems. The students can apply learned knowledge to their future research.

**COURSE CODE: L030903T**

**COURSE TITLE: Genomics and Proteomics**

This course aims to provide the knowledge and practical skills of functional genomics and proteomics. The course also teaches the techniques used in functional genomics such as microarrays, NGST, mRNA expression and miRNA expression. By the end of the course, students will have the necessary learning to radically advance our understanding of life and transform medicine.

**COURSE CODE: L030904T**

**COURSE TITLE: Fundamental Of Biostatistics And Biomaths**

The students will mathematically model, solve, and analyze problems in biomathematics, implement computational approaches to solve and analyze problems in biomathematics. They will be able to write lucidly about biomathematics. The students will speak fluently and coherently about biomathematics. They will be able to describe various application area of biostatistics, summarize, organize and display quantitative data, distinguish different types of data and sampling techniques, compute and interpret the result of correlation and regression analysis.



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**COURSE CODE: L030905T**

**COURSE TITLE: Animal Cell Culture and Medical Biotechnology**

Students get familiarized with the basic concepts of establishing animal cell cultures and understand the principles and applications of these technologies. It helps demonstrate antigen-antibody relationships and their detection methods, the biotechnological approaches to therapy and understand the principles of the new biotechnology-based assays and the therapeutic uses of plant products.

**COURSE CODE: L030906T**

**COURSE TITLE: Computational Biology and Bioinformatics**

On completion of the course the student will be able to get to know effective use of Office package, create a patient record database in MS Access and handle queries on the same ,store and retrieve drug related information using online tools and comprehend the utility of tools & databases available in genomic & proteomics.

### **M.Sc. Second Year: Semester IV**

**COURSE CODE: L031001T**

**COURSE TITLE: Bioprocess Technology**

On completion of the course, the student will understand the biological and kinetic concepts underlying bioprocesses engineering. Explain procedures for the design and control of bioreactors. They will understand the basic upstream processing principles and apply the bioprocess engineering in different industries for the benefit of mankind.

**COURSE CODE: L031002T**

**COURSE TITLE: Oncotechnology**

On completion of this course, the students will be able to understand the cellular and molecular



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basis of cancer, current strategies for cancer prevention and treatment. Take up the research in the frontier area of cancer biology

**COURSE CODE: L031003T**

**COURSE TITLE: Nanotechnology**

At the completion of this course, the students will be able to comprehend the nanoscale phenomenon associated with cellular nanostructures and reveal the nature of DNA bricks, aptamers and origami. They can design and utilize the protein and enzyme-based nanostructures and classify glycol nanostructures based on their binding ligands and have knowledge about membrane transport and membrane-based nanostructures and their uses.

**COURSE CODE: L031004T**

**COURSE TITLE: Neurosciences and Technology**

At the completion of this course, the students will be able to learn about anatomy and functioning of the central and peripheral nervous system. They will gain knowledge about various types of cells found in the nervous system and understand different types of learning and memory and senses and think about therapies for various neurological disorders.

**COURSE CODE: L031005T**

**COURSE TITLE: IPR, Bioethics and Entrepreneurship**

At the completion of this course, the students will be able to know about the teachings like good laboratory procedure and practices, standard operating procedures for biotechnology research, legal and institutional framework for biosafety, international agreements and protocols for biosafety. They will learn about the Intellectual property rights and their usages to protect work created by human mind that has commercial value. It will make the students aware about different national and international IPR issues including patents, trademarks, copyrights etc. and various international agreements and treaties.



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**COURSE CODE: L031006T**

**COURSE TITLE: Environment Biotechnology**

After completion of this course, the students will be able to apply the concepts of Biotechnology in Environmental Management and describe the concept of pollution management, bioremediation and biodegradation principles, processes and applications with advanced applications in wastewater, oil recovery, bio-hydrometallurgy, biofuel, carbon storage and capture, etc.



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### Department of Botany

#### B.Sc. (Botany)

#### PROGRAMME OUTCOMES (POs)

The new curriculum of B.Sc. in Science (Botany) offers essential knowledge and technical skills to study plants in a holistic manner. Students would be trained in all areas of plant biology using a unique combination of core, elective and vocational papers with significant interdisciplinary components. B.Sc. Botany program covers academic activities within the classroom sessions along with practical concepts at laboratory sessions. CBCS syllabus with a combination of general and specialized education shall introduce the concepts of breadth and depth in learning. This shall produce competent plant biologists who can employ and implement their gained knowledge in basic and applied aspects that will profoundly influence the prevailing paradigm of agriculture, industry, healthcare and environment to provide sustainable development. It will increase the ability of critical thinking, development of scientific attitude, handling of problems and generating solutions improve practical skills, enhance communication skill, social interaction and increase awareness in judicious use of plant resources by recognizing the ethical value system. The training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry along with graduate preparation for national as well as international competitive examinations, especially UGC-CSIR, NET, UPSC, Civil Services Examination, IFS, NSC, FCI, BSI, FRI etc. Certificate and diploma courses are framed to generate self-entrepreneurship and self-employability, if multi exit options opted lifelong learning can be achieved by drawing attention to the vast world of knowledge of plants and their domestication. In the field, outstation activities and projects are also required to be organized for real-life experience and learning. Candidates who have curiosity in plant kingdom, ecosystem, love exploring exotic places and wish to work as researchers or professions like Botanist, Conservationist, Ecologist, etc. can choose B.Sc. Botany course. Students would be exposed to cutting-edge technologies that are currently used in the study of plant life, their evolution and interactions with other organisms within the ecosystem. Students would also become aware of the social and environmental significance of plants and their relevance to the national economy.





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They will be equipped with practice & skills to deal with practical problems and versed with recent pedagogical trends in education including e-learning flipped class and hybrid learning to develop into responsible citizens for the nation – building and transforming the country towards the future with their knowledge gained in the field of plant science. Transformed curriculum shall develop educated outcome-oriented candidature, fostered with discovery-learning, equipped with practice & skills to deal practical problems and versed with recent pedagogical trends in education including e-learning flipped class and hybrid learning to develop into responsible citizen for nation – building and transforming the country towards the future with their knowledge gained in the field of plant science. In B.Sc. First year Certificate Course: Microbial Technology & Classical Botany involves Studying microbial technology provides insights into the applications of microorganisms in various industries, such as biotechnology and environmental management. B.Sc. second year Diploma in Plant Identification, Utilization Ethno medicine will cover conventional topics in field Botany like evolution and history & diversity of plants, complete morphology, nomenclature of plants, systems of classification, keys to important families of flowering plants, field data collection and herbarium techniques. In B.Sc. Third year outcomes of a three years' graduation course are aligned with program learning outcomes but these are specific to-specific courses offered in a program. The core courses shall be the backbone of this framework whereas discipline electives, generic electives and skill enhancement courses would add academic excellence in the subject together with a multi-dimensional and multidisciplinary approach.



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### COURSE OUTCOMES (COs)

#### *Certificate Course in Microbial Technology and Classical Botany*

#### **B.Sc. First Year: Semester I**

**COURSE CODE: B040101T**

**COURSE TITLE: Microbiology & Plant Pathology**

After the completion of the course the students will be able to:

- Develop understanding about the classification and diversity of different microbes including viruses, Algae, Fungi & Lichens & their economic importance.
- Develop conceptual skill about identifying microbes, pathogens, bio fertilizers and lichens. Gain knowledge about developing commercial enterprise of microbial products.
- Learn host-pathogen relationship and disease management. Gain Knowledge about uses of microbes in various fields.
- Understand the structure and reproduction of certain selected bacteria algae, fungi and lichens. Gain knowledge about the economic values of this lower group of plant community.

**COURSE CODE: B040102P**

**COURSE TITLE: Techniques In Microbiology & Plant Pathology**

Students will be able to-

- Understand the instrument, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory.



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- Develop skills for identifying microbes and using them for industrial, agriculture and environment purposes.
- Practical skills in the field and laboratory experiments in microbiology and pathology.
- Learn to identify algae, lichen and plant pathogens along with their symbiotic and parasitic associations.
- Can initiate his own plant and seed diagnostic clinic.
- Can start own enterprise on microbial products.

### **B.Sc. First Year: Semester II**

**COURSE CODE: B040201T**

**COURSE TITLE: Archegoniates and Plant Architecture**

After the completion of the course the students will be able to:

- Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
- Understanding of plant evolution and their transition to land habitat.
- Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding the basis of plant diversity, economic values and taxonomy of plants.
- Understand the details of external and internal structures of flowering plants.

**COURSE CODE: B040202P**

**COURSE TITLE: Land Plant Architecture**

After completion of the course:

- The students will be made aware of the group of plants that have given rise to land



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habit and the flowering plants.

- Students would learn to create their small digital reports where they can capture the zoomed in and zoomed out pictures as well as videos in case they are able to find some rare structure or phenomenon related to these plants.
- Develop an understanding by observation and table study of representative members of phylogenetically important groups to learn the process of evolution in a broad sense.
- Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding plant diversity, economic values and taxonomy of lower group of plants.
- Understand the composition, modification, internal structure and architecture of flowering plants for becoming a Botanist.

### **Diploma in Plant Identification, Utilization and Ethnomedicine**

#### **B.Sc. Second Year: Semester III**

**COURSE CODE: B040301T**

**COURSE TITLE: Flowering Plants Identification & Aesthetic Characteristics**

After the completion of the course the students will be able to:

- To gain an understanding of the history and concepts underlying various approaches to plant taxonomy and classification.
- To learn the major patterns of diversity among plants, and the characters and types of data used to classify plants.
- To compare the different approaches to classification with regard to the analysis of data. To become familiar with major taxa and their identifying characteristics, and to develop in depth knowledge of the current taxonomy of a major plant family.
- To discover and use diversity taxonomic resources, reference materials, herbarium collections, publications. For the entrepreneur career in plants, one can establish a nursery, start a landscaping business, Set up a farm or Run a plantation consultancy firm.



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- Learn Presentation skills (oral & writing) in life sciences by usage of computer and multimedia.

**COURSE CODE: B040302P**

**COURSE TITLE: Plant Identification Technology**

After the completion of the course the students will be able:

- To learn how plant specimens are collected, documented and curated for a permanent record.
- To observe, record and employ plant morphological variation and the accompanying descriptive technology.
- To gain experience with various tools and means available to identify plants.
- To develop observational skills and field experiences.
- To identify a taxonomically diverse array of native plants.
- To recognize common and major plant families.
- To understand aesthetic characters of flowering plants by making landscapes, gardens, bonsai, miniatures

### **B.Sc. Second Year: Semester IV**

**COURSE CODE: B040401T**

**COURSE TITLE: Economic Botany, Ethnomedicine and Phytochemistry**

After the completion of the course the students will be able to:

- Understand about the uses of plants – will know one plant- one employment. Understand phytochemical analysis related to medicinally important plants and economic products produced by the plants.
- Know about the importance of Medicinal plants and its useful parts, economically important plants in our daily life and also about the traditional medicines and herbs, and



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its relevance in modern times.

**COURSE CODE: B040402P**

**COURSE TITLE: Commercial Botany and Phytochemical analysis**

- After the completion of the course the students will be able to:
- Know about the commercial products produced from plants.
- Gain knowledge about cultivation practices of some economic crops.
- Understand about the ethnobotanical details of plants.
- Learn about the chemistry of plants and herbal preparations.
- Can become a protected cultivar, aromatic oil producer, and pharmacologist.

**Degree in Bachelor of Science**

**B.Sc. Third Year: Semester V**

**COURSE CODE: B040501T**

**COURSE TITLE: Plant Physiology, Metabolism And Biochemistry**

After the completion of the course the students will be able to:

- Understand the role of Physiological and metabolic processes for plant growth and development.
- Learn the symptoms of Mineral Deficiency in crops and their management.
- Assimilate Knowledge about Biochemical constitution of plant diversity.
- Know the role of plants in development of natural products, nutraceuticals, dietary supplements, and antioxidants.



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**COURSE CODE: B040502T**

**COURSE TITLE: Molecular Biology and Bioinformatics**

After the completion of the course the students will be able to:

- Understand nucleic acids, organization of DNA in prokaryotes and Eukaryotes, DNA replication mechanism, genetic code and transcription process.
- Know about Processing and modification of RNA and translation process, function and regulation of expression.
- Gain working knowledge of the practical and theoretical concepts of bioinformatics.

**COURSE CODE: B040503P**

**COURSE TITLE: Experiments in physiology, biochemistry and molecular biology**

After the completion of the course the students will be able to:

- Know and authenticate the physiological processes undergoing in plants along with their metabolism.
- Identify mineral deficiencies based on visual symptoms.
- Understand and develop skill for conducting molecular experiments for genetic engineering.

**COURSE CODE: B040504R**

**COURSE TITLE: Projects in Botany for Pre-graduation**

- Project work will supplement field experimental learning and deviations from classroom and laboratory transactions.
- Project work will enhance the capability to apply gained knowledge and understanding for selecting, solving and decision making processes.
- It will promote creativity and the spirit of enquiry in learners.



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- Students will learn to consult scientist libraries, laboratories and herbariums and learn the importance of discussion, Botanical and field trips, print and electronic media, internet etc. along with data documentation, compilation, analysis and representation in form of dissertation writing.
- It will enhance their abilities, enthusiasm and interest.
- Introduction of research project will inculcate research aptitude and passion for higher education and scientific research.

### **B.Sc. Third Year: Semester VI**

**COURSE CODE: B040601T**

**COURSE TITLE: Cytogenetics, Plant Breeding And Nanotechnology**

After the completion of the course the students will be able to:

- Acquire knowledge on cell ultrastructure.
- Understand the structure and chemical composition of chromatin and concept of cell division. Interpret the Mendel's principles; acquire knowledge on cytoplasmic inheritance and sex-linked inheritance.
- Understand the concept of 'one gene one enzyme hypotheses along with the molecular mechanism of mutation.

**COURSE CODE: B040602T**

**COURSE TITLE: Ecology and Environment**

After the completion of the course the students will be able to:

- Acquaint the students with complex interrelationship between organisms and environment.
- Make them understand methods for studying vegetation, community patterns and processes, ecosystem functions and principles of phytogeography.
- This knowledge is critical in evolving strategies for sustainable natural resource





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management and biodiversity conservation.

- Inculcating strong fundamentals on modern and classical aspects of Botany, understanding knowledge of Botany is an essential prerequisite for the pursuit of many applied sciences.
- It will facilitate students for taking up and shaping a successful career in Botany and allied sciences.

**COURSE CODE: B040603P**

**COURSE TITLE: Lab on Cytogenetics, Conservation & Environment management**

The students will be able to-

- Perform all the experiments related to plant tissue culture, plant breeding, conserving and depolluting the environment.
- Get employment in Environment Impact Assessment Companies and start their own venture.

**COURSE CODE: B040604R**

**COURSE TITLE: Project in Botany for Graduation**

- Project work will supplement field experimental learning and deviations from classroom and laboratory transactions.
- Project work will enhance the capability to apply gained knowledge and understanding for selecting, solving and decision-making processes
- It will promote creativity and the spirit of enquiry in learners.
- Students will learn to consult Scientists, libraries, laboratories and herbariums and learn importance of discussions, Botanical & field trips, print and electronic media, internet etc. along with data documentation, compilation, analysis & representation in form of dissertation writing
- It will enhance their abilities, enthusiasm, and interest.



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### M.Sc. (BOTANY)

#### PROGRAMME OUTCOMES (POs)

Unique ability of plants to capture solar energy and provide food for all cannot be replicated in any system. Plant science is now a fusion of basic and applied sciences. Conventional studies such as plant identification are now supplemented with advanced molecular techniques. All courses have been designed to benefit all students of Botany for studying various aspects of plant science including their practical applications. For accomplishing this many relevant topics environmental impact assessment, biodiversity studies, business, science writing has been included in the curriculum. Students will understand the classification of plants from cryptogams to spermatophytes so that they can identify flora in the field which expands their knowledge. Biodiversity study in relationship habitat will be correlated with climate change, soil and forest degradation. Applications of Botany in agriculture are through the study of plant pathology. They can understand the ultrastructure and function of cell membranes, cell communication, signaling, genetics, anatomy, taxonomy, ecology and physiology and plant biochemistry. They will understand the multi functionality of plant cells in the production of pure chemicals and their wide spectrum extended industrial applications. Students will gain insight into molecular and physiological adaptations of plants in response to biotic and abiotic stress. After completing the program, students will be able to gain the ability to apply scientific knowledge to formulate hypotheses and design experiments. Students will use quantitative reasoning using mathematical calculations and graphs. Effective communication and effective cooperation with other disciplines will extend communicating skills so that they can identify credible scientific sources for interpreting and evaluating evidence. This course is beneficial to understand the relationship between science and society through recognition and discussion on logical, scientific and ethical problems in the subject. Upon completion of the program, students will be specifically able to identify the classification of plants using key characters and they can understand the issue of development with respect to assessment, conservation and utilization of floral diversity. Students can apply selective techniques to screen and isolate fungi, plant pathogens, algae. Qualitative and quantitative estimation of the number of floral



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components by using enumeration and appropriate sampling techniques will improve their quantitative analysis capacity. Documentation and writing reports including experimental protocols, results and conclusions, study trips and visits etc. will make them aware of current scientific literature. Information about ecological and evolutionary characteristics of flora and fauna will bring them closer to the ecosystem. Students can discover new scientific information and compare it with existing information and know how all scientific knowledge is constantly evolving and dynamic. Students can find new information and compare it with existing information. Exploring traditional knowledge about plants yields insights into local ecosystems, sustainable practices, and potential medicinal applications. This research contributes to biodiversity conservation, the development of pharmaceuticals, and the identification of robust plant varieties for agriculture. Moreover, it facilitates collaboration between traditional and scientific communities, fostering cultural preservation and sustainable resource management.

### COURSE OUTCOMES (COs)

#### **M.Sc. First Year: Semester I**

**COURSE CODE: B040701T**

**COURSE TITLE: Diversity Of Microbes And Fungi**

After the completion of the course the students will be able to:

- Study microbes and fungi yields insights into various fields. Microbes play vital roles in nutrient cycling, disease processes, and biotechnological applications.
- Fungi contribute to ecosystems, food production, and medicine. Understanding these organism's aids in environmental management, drug development, and agricultural advancements.



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**COURSE CODE: B040702T**

**COURSE TITLE: Diversity Of Algae And Bryophytes**

After the completion of the course the students will be able to:

- Get an understanding about different habitats and range of thallus structure of algae and will be able to identify common algae.
- Understand the general characters and phylogeny of algae of different classes and their representative genera.
- Get an overview of industrial uses of algae as a source of biofuel, Agar, Nutraceuticals etc. and their role in bioremediation and wastewater treatment.
- Understand the morphological, anatomical and reproductive features of Hepaticopsida, Anthocerotopsida and Bryopsida.
- Get an insight about the ecological and economic importance of Bryophytes and will be able to differentiate between algae and bryophytes.

**COURSE CODE: B040703T**

**COURSE TITLE: Diversity of Pteridophytes and Gymnosperms**

After the completion of the course the students will be able-

- To learn general features, classification, affinities and economic importance of Pteridophytes and Gymnosperms.
- To understand the origin of Pteridophytes and Gymnosperms and their contribution in plant diversity and evolution.
- To compare morphology, anatomy, reproductive biology and evolutionary history of various groups of Pteridophytes and Gymnosperms.
- To understand the role of Pteridophytes like ferns in soil conservation and contribution of gymnosperms in forest ecosystems.
- To enhance their understanding of seedless vascular plants and seed-producing plants,



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impacting forestry, horticulture, and conservation efforts.

**COURSE CODE: B040704T**

**COURSE TITLE: Plant Ecology**

After the completion of the course the students will be able-

- Doing research in ecology yields crucial insights into ecosystems, biodiversity, and environmental dynamics.
- Understanding the ecological interactions helps address issues like habitat loss, climate change, and species conservation.
- Ecological studies inform sustainable resource management and guide policies for maintaining a balanced, resilient environment for future generations.

**COURSE CODE: B040705P**

**COURSE TITLE: Practical**

- Practical studies of algae, fungi, Bryophytes, Pteridophytes, Gymnosperms, and ecology provide hands-on experience in applied biology.
- This includes learning techniques for species identification, understanding growth conditions, and observing ecological interactions.
- Such practical knowledge is essential for fields like environmental science, agriculture, and forestry, enabling students to apply theoretical concepts to real-world scenarios and contribute to sustainable practices and conservation efforts.



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### M.Sc. First Year: Semester II

**COURSE CODE: B040801T**

**COURSE TITLE: Taxonomy of Angiosperms and Biosystematics**

After the completion of the course the students will be able to:

- Study taxonomy of angiosperms and biosystematics involves classifying and understanding the diversity of flowering plants.
- This knowledge aids in plant identification, conservation, and breeding programs. Biosystematics explores the evolutionary relationships among organisms, providing insights into their genetic diversity.
- These studies contribute to fields like agriculture, horticulture, and biodiversity conservation, shaping our understanding of plant life and facilitating informed decision-making in various scientific domains.

**COURSE CODE: B040802t**

**COURSE TITLE: Morphology, Anatomy and Embryology of Angiosperms**

After the completion of the course the students will be able to:

- Students will gain a comprehensive understanding of the morphological aspects of flowers with detailed examination of stamens and carpels and will explore the ontogeny of floral structures and inferior ovary,
- Students will understand the organization of primary meristems, structural and functional aspects of vascular and cork cambium and phenomenon of anomalous secondary growth in plants. Examine the anatomical features of leaves, abscission layer, anatomical organization of nodes and the transition between roots and stem tissues. Students will investigate the structural characteristics of wood, trichomes, and stomata, and evaluate their taxonomic significance in plant classification and evolutionary relationships.



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- Students will gain a comprehensive understanding of plant embryology, including the processes of microsporogenesis, megasporogenesis leading to the production of male and female gametophytes. Analyze the structure and types of embryo sacs, process of fertilization, endosperm development, embryo formation, and variations in reproductive strategies such as polyspermy, heterofertilization, apomixis, diplospory, apospory, adventive embryony, polyembryony and induced parthenocarpy and their implications for reproductive strategies and seed formation.

**COURSE CODE: B040803t**

**COURSE TITLE: Cytogenetics & Basic Molecular Biology**

After the completion of the course the students will be able to:

- Study cytogenetics and basic molecular biology provides foundational knowledge in genetics and cellular processes.
- Cytogenetics explores chromosomal structures and abnormalities, aiding in the diagnosis of genetic disorders.
- Basic molecular biology investigates cellular mechanisms, DNA replication, and gene expression, forming the basis for biotechnological advancements.
- This understanding is crucial in fields such as medicine, agriculture, and biotechnology, facilitating advancements in genetic research, medical diagnostics, and the development of genetically modified organisms for improved crops

**COURSE CODE: B040804t**

**COURSE TITLE: Palaeobotany**

After the completion of course the students will be able-

- To understand Pre-biotic Environment, chemical evolution & origin of life, Pre-Cambrian life and stratigraphy.
- To understand the structure of Earth, Tectonic plates, continental drift, geological time scale, types of rocks and principles of stratigraphy.



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- To understand the process of fossilization, types of fossils, reconstruction and nomenclature of fossils.
- To learn the applied aspects of Palaeobotany.

**COURSE CODE: B040805T**

**COURSE TITLE: Plant Breeding and Elementary Biostatistics**

After the completion of the course the students will be able to:

- Develop improved plant varieties with desirable traits, enhancing agricultural productivity.
- Elementary biostatistics enables the quantitative analysis of biological data, aiding in experimental design and data interpretation.
- Together, these studies contribute to advancements in agriculture, environmental science, and our understanding of plant evolution, fostering sustainable practices and informed decision-making in plant-related research and industries.

**COURSE CODE: B040806P**

**COURSE TITLE: Practical**

- Studying practical aspects in morphology, embryology, cell and molecular biology, plant breeding, and biostatistics in botany can result in a comprehensive understanding of plant structure, development, genetics, and statistical methods.
- This knowledge is crucial for advancements in crop improvement, genetic engineering, and sustainable agriculture.
- Practical applications may include the development of disease-resistant plants, improved crop yields, and the implementation of effective statistical analyses for experimental data in botanical research.
- Overall, these studies contribute to informed decision-making in plant sciences and have practical implications for agriculture and plant-related industries





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**COURSE CODE: B040807r**

**COURSE TITLE: Research Project**

- Morphological studies involve practical applications in plant structure and function, aiding in botanical research and identification.
- Plant breeding projects focus on developing new crop varieties with improved traits, enhancing agricultural productivity.
- Embryological research projects contribute to our understanding of reproductive processes, influencing plant breeding and genetic studies. Overall, these projects collectively advance scientific knowledge, contribute to applied fields like agriculture, and have implications for environmental conservation and biotechnology.

### **M.Sc. Second Year: Semester III**

**COURSE CODE: B040901T**

**COURSE TITLE: Plant Physiology and Biochemistry**

- Understand the physiological processes in plants such as transpiration, xylem and phloem transport, respiration, ATP synthesis, C<sub>3</sub>, C<sub>4</sub> and CAM pathways of photosynthesis and their physiological and ecological significance.
- Get an overview of the role of plant hormones in growth and development and their commercial uses to increase crop productivity. They will also understand about the endogenous clock, the process of photoperiodism and floral induction mechanisms.
- Understand the physico-chemical properties and mechanism of action of enzymes.
- Get an idea about the biological significance and structure of important lipids.



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**COURSE CODE: B040902T**

**COURSE TITLE: Plant Biotechnological and Molecular Techniques**

- Biotechnological Innovations, contribute to advancements in biotechnology, including genetic engineering, personalized medicine, and bioinformatics.
- Applications range from developing new pharmaceuticals and vaccines to genetically modifying crops for improved yield and resistance.
- Understanding molecular techniques also contributes to unraveling the complexities of diseases, enabling targeted therapies.
- Additionally, biotechnology plays a role in environmental remediation and the production of biofuels.
- The interdisciplinary nature of these fields fosters innovation and contributes to addressing global challenges in health, food security, and sustainability.

**COURSE CODE: B040903T**

**COURSE TITLE: Plant Tissue Culture**

- Micropropagation: techniques to rapidly propagate plants from small amounts of tissue, enabling mass production of genetically identical plants.
- Genetic Modification: Understand methods for introducing, selecting, and maintaining specific genetic traits in plants, contributing to crop improvement and biotechnological applications.
- Disease-Free Plants: Develop skills to produce disease-free plants by sterilizing and culturing tissues, minimizing the risk of pathogens and pests.
- Conservation of Endangered Species: Contribute to the conservation of endangered plant species by cultivating them in vitro, preserving genetic diversity.
- Secondary Metabolite Production: Explore the production of secondary metabolites, such as pharmaceutical compounds, through controlled tissue culture conditions.
- Crop Improvement: Contribute to the development of improved crop varieties with



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desirable traits, such as increased yield, resistance to pests, and tolerance to environmental stress.

- Research Opportunities: Engage in research to understand fundamental aspects of plant growth, development, and physiology at the cellular and molecular levels.

**COURSE CODE: B040904T**

**COURSE TITLE: Basic Bioanalytical Techniques**

- Students will learn different types of Microscopy like light, phase contrast, confocal, fluorescence, SEM and TEM.
- They will learn basic concepts of paper chromatography, thin layer chromatography, HPLC, GC, ion exchange and affinity chromatography.
- They will learn different labeling techniques of biomolecules and their detection.
- They will learn the techniques of isolation and purification of DNA, RNA and Proteins.
- Students will learn different electrophoresis techniques.

**COURSE CODE: B040905T**

**COURSE TITLE: Biodiversity and Conservation**

- Ecological Understanding: Gain a comprehensive understanding of ecosystems, species interactions, and the importance of biodiversity in maintaining ecological balance.
- Species Identification: Develop skills in identifying and classifying various species, both flora and fauna, contributing to the documentation of biodiversity.
- Conservation Strategies: Learn about conservation methods, habitat restoration, and sustainable practices to mitigate threats to biodiversity and protect endangered species.
- Environmental Policy and Management: Understand the legal and policy frameworks related to biodiversity conservation and environmental management.
- Ecosystem Services: Recognize the vital services ecosystems provide to human well-being, such as pollination, water purification, and climate regulation. Global



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Perspectives: Explore global biodiversity patterns, conservation challenges, and international efforts to address issues like deforestation, climate change, and habitat loss.

- Community Engagement: Learn to involve local communities in conservation efforts, considering the socio-economic aspects of biodiversity conservation.
  - Fieldwork Skills: Develop practical skills through fieldwork, research projects, and data collection, enhancing the ability to assess and monitor biodiversity
  - Awareness and Advocacy: Become an advocate for biodiversity conservation, raising awareness about the importance of preserving diverse ecosystems and species.
- Research Opportunities: Engage in research to contribute new knowledge and insights into biodiversity patterns, threats, and conservation strategies.

**COURSE CODE: B040906t**

**COURSE TITLE: Medicinal and Aromatic Plants**

Students will be able to-

- Understand the past and present status of medicinal and aromatic plants.
- Understand the bioactive molecules and therapeutic value of some medicinal plants of India.
- Get knowledge about nutraceuticals and medicinal foods.
- Gain knowledge about important aromatic plants of India.
- Learn the technique of extraction of essential oils from aromatic plants, their use in cosmetics and perfumery.
- Learn commercial cultivation of medicinal and aromatic plants.



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**COURSE CODE: B040907P**

**COURSE TITLE: Practical**

- Studying biotechnology, tissue culture, and biodiversity would typically involve gaining hands-on experience and practical skills in these respective fields.
- Some potential outcomes could include: Physiology: Understanding the functioning of biological systems.
- Conducting experiments to measure physiological parameters. Analyzing data related to physiological responses.
- Biotechnology: Learning laboratory techniques for genetic engineering or DNA manipulation. Executing experiments related to bioprocessing or bioinformatics.
- Gaining insights into the practical applications of biotechnology. Tissue Culture: Cultivating and maintaining cells or tissues in controlled environments.
- Performing experiments related to cell growth, differentiation, or transformation. Acquiring skills in aseptic techniques crucial for tissue culture work.
- Biodiversity: Identifying and cataloging various species in a given ecosystem. Conducting field surveys to assess biodiversity. Analyzing the impact of environmental factors on different species.



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### M.Sc. Second Year: Semester IV

**COURSE CODE: B041001T**

**COURSE TITLE: Advanced Genetics & Molecular Biology**

- Studying advanced genetics and molecular biology can lead to a deeper understanding of genetic mechanisms, gene expression, and molecular processes within cells. This knowledge is crucial in various fields.
- Biomedical Research: Unraveling complex genetic pathways can contribute to advancements in disease understanding, drug development, and personalized medicine.
- Genetic Engineering: Mastery in molecular biology enables the manipulation of DNA, leading to innovations such as gene therapy, genetically modified organisms, and synthetic biology.
- Medical Diagnostics: Insights gained from advanced genetics can enhance diagnostic tools, aiding in the identification and treatment of genetic disorders.
- Pharmaceuticals: Understanding molecular interactions facilitates drug design, targeting specific pathways for therapeutic interventions.
- Agriculture: Applied genetics plays a role in developing genetically modified crops with improved traits, enhancing food production and resilience.
- Evolutionary Biology: Molecular techniques help trace evolutionary relationships and understand the genetic basis of biodiversity.
- Forensic Science: DNA analysis, rooted in molecular biology, is essential for forensic identification and solving criminal cases.
- Biotechnology: Advances in genetics contribute to the development of new biotechnological tools, gene editing to synthetic biology applications.
- Overall, a profound grasp of advanced genetics and molecular biology opens avenues for groundbreaking research and applications.



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**COURSE CODE: B041002T**

**COURSE TITLE: Advanced Plant Pathology**

- Studying advanced plant pathology can lead to a deeper understanding of plant diseases, their causes, and management strategies.
- Graduates may contribute to agriculture by developing disease-resistant crops, implementing effective control measures, and advancing sustainable agricultural practices.
- Additionally, they may pursue careers in research, academia, or agricultural consultancy to address emerging challenges in plant health.

**COURSE CODE: B041003T**

**COURSE TITLE: Advanced Phycology**

Students will be able to learn-

- Distribution pattern of marine algae in Indian coastal areas.
- Isolation, purification and mass culture of algae
- Biochemistry of algal pigments, reserve food materials and cell wall composition
- Role of algae in global climate regulation, land reclamation and biological nitrogen fixation
- Algae and environmental pollution
- Algae as food and fodder



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**COURSE CODE: B041004T**

**COURSE TITLE: Environmental Science**

Students will be able to learn-

- Earth's environment and its evolution
- Atmospheric Gaseous composition and climate
- Phenomenon, causes and consequences of Ozone layer depletion
- Classification of water bodies
- Effect of water pollution and water management strategies
- Soil, thermal and noise pollution
- Basic concepts of sustainable development and environmental laws.

**COURSE CODE: B041005T**

**COURSE TITLE: Advanced Plant Physiology and Biochemistry**

After the completion of the course the students will be able to apply physiological concepts to improve agricultural practices, increase the yield of plants and to develop climate resilient plants. The students will be able to

- Understand the light perception mechanisms mediated by Phytochromes, Cryptochromes, and Phototropins.
- Students will get a comprehensive knowledge of cell signaling pathways, biotic and abiotic stress tolerance in plants and importance of secondary metabolites.
- Get an insight into the mechanism of biological nitrogen fixation and uptake of nitrate and sulphate.
- Understand the physico-chemical properties of amino acids and their importance in protein folding and stabilization of secondary, tertiary and quaternary structures and an overview and significance of Ramachandran plot in structural biology.





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- Finally, students will gain insight into the classification, structure, properties and importance of carbohydrates, Vitamins and coenzymes, highlighting their indispensable roles in plant metabolism and physiology.

**COURSE CODE: B041006T**

**COURSE TITLE: Environmental & Applied Microbiology**

The study of environmental and applied microbiology yields various outcomes including:

- **Bioremediation:** Understanding microbial processes aids in developing strategies for cleaning up polluted environments by harnessing the natural capabilities of microorganisms.
- **Waste Treatment:** Applied microbiology contributes to the development of efficient waste treatment systems, such as sewage treatment plants, where microbes play a crucial role in breaking down organic matter.
- **Food Production and Safety:** Microbial studies help ensure food safety by examining foodborne pathogens, as well as facilitating the production of fermented foods and probiotics.
- **Agricultural Applications:** Microbes are used in agriculture for tasks like enhancing soil fertility, promoting plant growth, and controlling plant diseases, reducing the reliance on chemical fertilizers and pesticides.
- **Biotechnology:** Microbes are harnessed for the production of various biotechnological products, including antibiotics, enzymes, and biofuels.

**COURSE CODE: B041007T**

**COURSE TITLE: Conservation and Restoration Ecology**

Students will be able to learn-

- Principles, postulates and ethics of conservation ecology.



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- Population dynamics and conservation.
- Species and habitat conservation.
- Ecology of disturbed ecosystems, aims& strategies of their restoration.
- Degradation and restoration of natural ecosystems.

**COURSE CODE: B041008T**

**COURSE TITLE: Bioinformatics and Intellectual Property Rights (IPRs)**

Students will be able to learn-

- Introduction to Databases like NCBI, EMBL, PDB, Gene Bank etc.
- Bioinformatics tools and software like BLAST, FASTA, Primer designing, Phylogenetic tree etc.
- Intellectual Property Rights, World Intellectual Property Organization (WIPO) and its role.
- Patent- kinds, criteria, procedure, copyright and trademark, organization of Patent Offices in India.

**COURSE CODE: B041009T**

**COURSE TITLE: Biofertilizer Technology**

Students will be able to learn-

- Definition, types and application of Biofertilizers
- Characteristics of biofertilizers like *Azotobacter*, *Azospirillum*, *Rhizobium* etc.
- Biological nitrogen fixation
- Legume symbiosis
- Production Technology



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**COURSE CODE: B041010T**

**COURSE TITLE: Microbial Genetics**

Students will be able to learn-

- Tools of microbial genetics
- Structure of transposons, Transposon mutagenesis
- Molecular models and mechanism of genetic recombinations
- Cell signaling
- Gene expression and regulation
- Use of microbes in Genetic Engineering

**COURSE CODE: B041011P**

**COURSE TITLE: Practical**

- Disease Management Strategies: Identify effective strategies for controlling plant diseases through the understanding of pathogen interactions, leading to advancements in disease management.
- Crop Improvement: Apply genetic and molecular techniques to enhance plant resistance to diseases, optimizing crop performance and yield.
- Environmental Adaptation: Investigate plant physiological responses to environmental stressors, contributing to the development of stress-resistant crops and sustainable agricultural practices.
- Biotechnological Applications: Utilize molecular biology tools for genetic engineering, enabling the development of genetically modified plants with improved traits, such as resistance to pests or enhanced nutritional content.
- Scientific Publications: Contribute to scientific literature by publishing research findings, advancing the collective knowledge in the fields of plant pathology, plant physiology, genetics, and molecular biology.



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- Microbial indicators are employed to assess environmental quality, helping to monitor and manage ecosystems, water bodies, and air quality.
- Vaccine Development: Research in environmental and applied microbiology contributes to the development of vaccines, preventing infectious diseases caused by pathogenic microorganisms.

**COURSE CODE: B041012R**

**COURSE TITLE: Research Project**

Assigning research projects to students in botany postgraduate courses

- Allows students to engage deeply with course material, develop critical thinking and analytical skills, and apply theoretical knowledge to real-world problems.
- Research projects provide opportunities for students to develop scientific inquiry skills, experimental design abilities, data analysis techniques, and communication skills through the presentation and dissemination of their findings.
- By actively participating in research projects, students can achieve a comprehensive understanding of the subject matter while also contributing to the advancement of knowledge in the field of botany.



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### Department of Chemistry

#### B.Sc. (Chemistry)

#### PROGRAMME OUTCOMES (POs)

Students will be able to learn about the fundamentals and applications of recent theories of chemical science including analytical, inorganic, organic and physical chemistry they will be able to design and carry out scientific experiments, explore new areas in research, problem solving, critical thinking etc. students will be able to function as a member of an interdisciplinary problem solving team.

#### COURSE OUTCOMES (COs)

##### *Certificate in Bio-organic and Medicinal Chemistry*

#### B.Sc. First Year: Semester I

COURSE CODE- B020101T

COURSE TITLE- Fundamentals of chemistry

Students will gain understanding of molecular geometry, bonding of molecules, kinetics.

COURSE CODE- B020102P (PRACTICAL)

COURSE TITLE-Quantitative analysis

Students will learn estimation techniques, portability tests of water samples, estimation of inorganic salts, metal ions, and alkali and acid contents in samples.



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### **B.Sc. First Year: Semester II**

**COURSE CODE- B020201T**

**COURSE TITLE- Bio organic and medicinal chemistry**

Students will learn about physiological and functional chemistry of biomolecules such as carbohydrates, proteins, nucleic acids and medicinal chemistry.

**COURSE CODE- B020202P (PRACTICAL)**

**COURSE TITLE- Biochemical Analysis**

This course will provide basic qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids and drug molecules. After successful completion of this course students may get job opportunities in food, beverage and pharmaceutical industries.

### ***Diploma in Chemical Dynamics and Analytical Techniques***

### **B.Sc. Second Year: Semester III**

**COURSE CODE- B020301T**

**COURSE TITLE- Chemical dynamics and coordination chemistry**

This course will provide knowledge of characteristics and physical properties of three states of matter, chemical kinetics, coordination chemistry, spectroscopy and magnetism. After the completion of the course the students will be able to understand metal- ligand bonding in transition metal complexes, thermodynamic and kinetic aspects of metal complexes.



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**COURSE CODE- B020302P (PRACTICAL)**

**COURSE TITLE-Physical Analysis**

The students will be able to learn to calibrate apparatus and prepare solutions and estimation through volumetric analysis. They will also learn dilatometric experiments: one and two component phase equilibrium experiments.

### **B.Sc. Second Year: Semester IV**

**COURSE CODE- B020401T**

**COURSE TITLE- Quantum mechanics and analytical techniques**

This course will be able to provide knowledge of atomic structure, elementary quantum mechanics, wave function and different molecular spectroscopy.

**COURSE CODE- B020402P (PRACTICAL)**

**COURSE TITLE- Instrumental analysis**

Students will be able to employ critical thinking and scientific enquiry, design, interpretation and documentation of laboratory experiments. Students will learn purification, solvent extraction, TLC, column chromatography, IR and NMR spectroscopic techniques. The students can get an entry level position in a chemical industry.

### ***Degree in Bachelor of Science***

### **B.Sc. Third Year: Semester V**

**COURSE CODE-B020501T**

**COURSE TITLE-Organic Synthesis A**

This course will provide the synthesis and chemical properties of different organic compounds like alkanes, alkenes, alkynes, alcohols, phenols and also help in drug designing.



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**COURSE CODE- B020502T**

**COURSE TITLE-Rearrangements And Chemistry Of Group Elements**

This paper will provide detailed knowledge of synthesis of different organic compounds and functional group inter conversion.

**COURSE CODE- B020503P (PRACTICAL)**

**COURSE TITLE- Qualitative Analysis**

After completion of this course students will have the knowledge and skill to understand the laboratory methods and tests related to inorganic mixture and organic compounds.

### **B.Sc. Third Year: Semester VI**

**COURSE CODE- B020601T**

**COURSE TITLE- Organic Synthesis**

This paper will provide detailed knowledge of synthesis of various classes of organic compounds and functional group inter conversion, study of natural products and heterocyclic compounds.

**COURSE CODE- B020602T**

**COURSE TITLE- Chemical Energetics and Radiochemistry**

After successful completion of this course students will be able to describe laws of thermodynamics and its application, phase equilibria, electrochemistry, ionic equilibrium applications.

**COURSE CODE- B020603P (PRACTICAL)**

**COURSE TITLE- Analytical Methods**

This course will provide an idea of gravimetric analysis, paper and TLC chromatography and thermochemistry.





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**COURSE CODE- B020604R**

**COURSE TITLE-Research Project**

### **M.Sc. (Chemistry)**

#### **PROGRAMME OUTCOMES (POs)**

This program is mainly focused on research and development areas in chemical sciences. The motto of this syllabus is to encourage the students how to develop experimental ideas of research for the development of our nation.

#### **COURSE OUTCOMES (COs)**

##### **M.Sc. First Year: Semester I**

**COURSE CODE- B020701T**

**COURSE TITLE- Inorganic Chemistry**

This course will provide an idea of stereochemistry metal ligand equilibria in solutions, reaction mechanism of transition metal complexes and metal ligand bonding.

**COURSE CODE- B020702T**

**COURSE TITLE-Organic Chemistry**

Students will learn bonding in organic molecules, reaction mechanism: structure and reactivity, aliphatic nucleophilic substitution and aliphatic electrophilic substitution reaction.

**COURSE CODE- B020703T**

**COURSE TITLE- Physical Chemistry**

This course will provide ideas about quantum chemistry and thermodynamics.



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**COURSE CODE- B020704T**

**COURSE TITLE- Spectroscopy**

Students will learn different spectroscopic techniques for example microwave, vibrational, NMR, ESR NQRS etc.

**COURSE CODE- B020705P (PRACTICAL)**

Students will practically learn quantitative analysis of inorganic ions including rare metal ions, paper and column chromatography, separation, purification and identification of organic compounds of binary mixture.

**COURSE CODE- B020706R**

**COURSE TITLE-Research Project**

### **M.Sc. First Year: Semester II**

**COURSE CODE- B020801T**

**COURSE TITLE- Inorganic Chemistry**

This course will provide an idea of electronic spectra and magnetic properties of transition metal complexes, metal clusters etc.

**COURSE CODE- B020802T**

**COURSE TITLE- Organic Chemistry**

Students will learn reaction mechanisms like AES, ANS, free radical reaction, elimination reactions and pericyclic reactions.

**COURSE CODE-B020803T**

**COURSE TITLE- Physical chemistry**

Students will learn about chemical dynamics, surface chemistry and electrochemistry.



## **DAYANAND GIRLS' P.G. COLLEGE, KANPUR**

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**COURSE CODE- B020804T**

**COURSE TITLE- Environmental Chemistry (Major and Minor)**

This course will provide the idea of environment, hydrosphere, atmosphere, industrial pollution and toxicology.

**COURSE CODE- B020806P**

**COURSE TITLE-Practical**

Students will learn the preparation and properties of different inorganic and organic compounds and quantitative analysis of amines, phenols and BOD, COD of water samples.

**COURSE CODE- B020807R**

**COURSE TITLE-Research Project**

### **M.Sc. Second Year: Semester III**

**COURSE CODE- B020901T**

**COURSE TITLE- Bio-inorganic, Bio-organic and Biophysical chemistry**

This course will provide an idea of metal ions in biological systems, ATP cycle, enzymes and their action, biological cell and its constitution.

**COURSE CODE- B020902T**

**COURSE TITLE- Applications of Spectroscopy**

Students will learn inorganic spectroscopy like ESR and Mossbauer, organic spectroscopy like UV IR and NMR.

**COURSE CODE-B020904T**

**COURSE TITLE-Photochemistry (Elective paper)**

Students will learn photochemical laws and reactions of alkenes, carbonyl compounds, organic compounds and different aromatic compounds.



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**COURSE CODE-B020905T**

**COURSE TITLE- Organotransition Metal Chemistry (Elective Paper)**

Students will learn about the compounds of transition metals and carbon multiple bonds, homogeneous catalysis and fluxional organometallic compounds.

**COURSE CODE- B020907 P**

**COURSE TITLE-Practical**

Students will learn to prepare organic compounds, their determination and spectrophotometric study of different inorganic ions, chromatographic separation of ions, phase equilibria, conductometry, potentiometry and polarimetry.

**COURSE CODE- B020908R**

**COURSE TITLE-Research Project**

### **M.Sc. Second Year: Semester IV**

**COURSE CODE- B0201001T**

**COURSE TITLE- Organic Synthesis (Elective Paper)**

Students will learn about organometallic reagents, transition metals, reduction and oxidation processes and rearrangements.

**COURSE CODE- B0201002T**

**COURSE TITLE-Heterocyclic Chemistry (Elective Paper)**

This course will provide an idea of different aromatic and non-aromatic heterocyclic compounds and their synthesis and reactions.

**COURSE CODE- B0201003T**

**COURSE TITLE- Chemistry of Natural products (Elective paper)**

Students will learn about natural products for example terpenoids, for example terpenoids, alkaloids, steroid, plant pigments, porphyrins and prostaglandins.



## **DAYANAND GIRLS' P.G. COLLEGE, KANPUR**

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**COURSE CODE- B0201009T**

**COURSE TITLE- Industrial Chemistry (Elective paper)**

Students will learn about cement, ceramic glass, fertilizers, petrochemicals, lubricants and paints.

**COURSE CODE- B02011010T**

**COURSE TITLE-Practical**

Students will learn about qualitative analysis, multistep organic synthesis, extraction of organic compounds from natural sources, spectrophotometric estimation, physical chemistry like thermodynamics, spectroscopy, polarography and electronic experiments etc.

**COURSE CODE- B02011011R**

**COURSE TITLE- Research Project**



# DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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## Department of Computer Application

### B.A. / B.Sc. (Computer Applications)

#### PROGRAMME OUTCOMES (POs)

- To prepare students to undertake careers involving problem solving using computer science and technologies.
- Develop ability to analyze a problem, identify and define computing requirements.
- Develop ability to pursue advanced studies and research in the related field.
- To produce entrepreneurs who can innovate and develop software product.
- To prepare expertise in a particular area of computer science which can make them more competitive in the job market and open new career opportunities in various sectors like Banking, Insurance, MNCs , IT industries, corporate sectors etc.

#### COURSE OUTCOMES (COs)

##### First Year: Semester I

**COURSE CODE: B120101T**

**COURSE TITLE: Computer Fundamental with Problem Solving using Python**

After the completion of the course the students will be able to:

- Understand hardware components of the computer system, aware of the software of computer systems and working with Windows operating system.
- Develop basic understanding about problem solving using the concept of algorithm and algorithmic thinking.
- Understanding about computer mathematics, number system, codes circuit system and gates.
- To learn and understand Python Programming looping, control statements and string manipulation.



## **DAYANAND GIRLS' P.G. COLLEGE, KANPUR**

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**COURSE CODE: B120102P**

**COURSE TITLE: Software Lab using Python**

After the completion of the course the students will be able to:

- To learn the basics of Python programming.
- To learn and understand Python Programming looping, control statements and string manipulation.
- Students should be made familiar with the concepts of GUI controls and designing and applications.

**First Year: Semester II**

**COURSE CODE: B120201T**

**COURSE TITLE: Database Management System**

After the completion of the course the students will be able to:

- Understand the basic concepts of database management systems.
- Design the E-R diagrams for real world applications.
- Formulate relational algebraic expressions using relational data models and languages.
- Apply normalization, transaction properties and concurrency control to design databases.
- Analyze the security algorithm for database.

**COURSE CODE: B120202P**

**COURSE TITLE: DBMS Lab using MySQL**

After the completion of the course the students will be able to:

- Understand, analyze and apply common SQL queries using DDL, DML and DCL commands.
- Design and implement the database for the given problem.
- Database connectivity via PHP and MySQL.



## **DAYANAND GIRLS' P.G. COLLEGE, KANPUR**

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### **Second Year: Semester III**

**COURSE CODE: B120301T**

**COURSE TITLE: C Programming with Data Structure**

**Programme / class: Diploma**

After the completion of the course the students will be able to:

- Understand the basics of C Programming.
- Learn about C looping, control statements, string manipulation and pointers.
- To learn and understand the concepts of Data structure

**COURSE CODE: B120302P**

**COURSE TITLE: C Programming with Data Structure lab**

After the completion of the course the students will be able to:

- To learn and practical basics of C Programming.
- Practical working of C looping, control statements, string manipulation and pointers.
- To learn and understand the concepts of Data structure like Stack, Queue, Linked list, Trees and Graphs etc.

### **Second Year: Semester IV**

**COURSE CODE: B120401T**

**COURSE TITLE: Operating System**

After the completion of the course the students will be able to:

- Understand role, functionality, features, working, design and types of Operating system.
- To understand Process scheduling, memory management, file management, I/O management and security about the operating systems.
- To understand inter-processes communication, deadlock and its handling techniques.





## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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**COURSE CODE: B120402P**

**COURSE TITLE: Operating System Lab**

After the completion of the course the students will be able to:

- Understanding the working of LINUX operating system, working of its commands and shell programming.
- Simulate and demonstrate the concept of an operating system.

### **Third Year: Semester V**

**COURSE CODE: B120501T**

**COURSE TITLE: Java Programming**

After the completion of the course the students will be able to:

- Understand the Java Programming basics.
- To understand Java statements, looping, control statements and string manipulations.

**COURSE CODE: B120502T**

**COURSE TITLE: Introduction to Data Science and Machine Learning**

After the completion of the course the students will be able to:

- Students will be able to develop relevant programming.
- Students will be able to build and assess access data-based models
- Students learn, understand and practice big data analytics and machine learning approaches.

**COURSE CODE: B120503P**

**COURSE TITLE: Java Programming Lab**

After the completion of the course the students will be able to:

- Understand the Java Programming basics.
- To understand Java statements, looping, control statements and string manipulations.
- Working of Java applets.



## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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- Dealing with the Java Exception Handling.

**COURSE CODE: B120504R**

**COURSE TITLE: Project work**

### **Third Year: Semester VI**

**COURSE CODE:**

**COURSE TITLE: Data Communication and Computer Network (DCCN)**

After the completion of the course the students will be able to:

- Understand the basics of computer networks and various protocols.
- Students will be able to administrate the network and flow of information.
- Further, they will be able to understand the network security, mobile and ad-hoc networks.

**COURSE CODE:**

**COURSE TITLE: Web Technology**

After the completion of the course the students will be able to:

- Understand the HTML/ DHTML tags.
- Understand CSS.
- Interactive learning.

**COURSE CODE:**

**COURSE TITLE: PROJECT**

### **Research Project for V and VI Semester**

After the completion of the project the students will be able to:

- Students will be able to formulate and solve real world problems.
- They will be able to develop and work on different projects.
- Students will be able to interact with the people and present them confidently.
- Will be able to serve in various sectors like Banking, Insurance, MNCs, IT industries and corporate sectors etc.



# DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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## Department of Information Technology

### B.Sc. (Information Technology)

#### PROGRAMME OUTCOMES (POs)

This program imparts knowledge on various fields of computers and information technology through teaching, interaction, practical's and multimedia aids. It shall be very useful to give an idea of upcoming technologies in the digital era of artificial intelligence. It is job oriented and fulfills the industry demands of the present scenario. Students would gain wide knowledge of following aspects:

1. Computer basics and fundamentals
2. Hardware and software
3. Algorithm and flowcharts
4. Problem definition and solution with coding language like python,
5. Website making tools
6. Server and clients
7. Web development
8. Web technology and many more

#### COURSE OUTCOMES (COs)

##### **B.Sc. First Year: Semester I**

**COURSE CODE: B180101T**

**COURSE TITLE: Fundamentals and Problem Solving using computer**

**CO1:** Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts

**CO2:** Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.

**CO3:** Develops the ability to analyze a problem, develop an algorithm to solve it.

**CO4:** Develops the use of the Python programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.



## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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**COURSE CODE: (Practical)**

**COURSE TITLE: Programming Lab using Python**

1. To learn and understand Python programming basics.
2. To learn and understand python looping, control statements and string manipulations.
3. Students should be made familiar with the concepts of GUI controls and designing GUI applications.

### **B.Sc. First Year: Semester II**

**COURSE CODE: B180201T**

**COURSE TITLE: Operating System**

This program imparts knowledge on various fields of computers and information technology through teaching, interaction, practical's and multimedia aids. It shall be very useful to give an idea of upcoming technologies in the digital era of artificial intelligence. It is job oriented and fulfills the industry demands of the present scenario. Students would gain wide knowledge of following aspects:

1. Various operating systems
2. Memory management
3. Process management
4. Process states and life cycles
5. Scheduling and Deadlocks

After the completion of the course the students will be able to:

1. Understand role, responsibilities, features, and design of operating system.
2. Analyze memory management schemes and process scheduling algorithms.
3. Apply process synchronization techniques to formulate solutions for critical section problems.
4. Illustrate concept of disk scheduling.
5. Evaluate process deadlock handling techniques.



## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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**COURSE CODE: (Practical)**

**COURSE TITLE: Operating System Lab**

Ability to:

1. Use of the UNIX operating system and be able to write shell programs.
2. Simulate and demonstrate the concepts of operating systems.

### **B.Sc. Second Year: Semester III**

**COURSE CODE: B180301T**

**COURSE TITLE: Object Oriented Programming with Java Code**

This program imparts knowledge on various fields of computers and information technology through teaching, interaction, practical's and multimedia aids. It shall be very useful to give an idea of upcoming technologies in the digital era of artificial intelligence. It is job oriented and fulfills the industry demands of the present scenario. Students would gain wide knowledge of following aspects-

1. Various problem solving techniques
2. Data structures
3. simple object-oriented software
4. software development tools

1: Understand that various problem solving categories exist such as; iterative technique, divide and conquer, dynamic programming, greedy algorithms, and understand various searching and sorting algorithms

2: Employ a deep knowledge of various data structures when constructing a program.

3: Design and construct simple object-oriented software with an appreciation for data abstraction and information hiding.

4: Effectively use software development tools including libraries, compilers, editors, linkers and debuggers to write and troubleshoot programs.

**COURSE CODE: (Practical)**

**COURSE TITLE: Java Lab**

1. Ability to learn and understand Java programming basics.
2. Ability to learn and understand Java looping, control statements and string manipulations.



## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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### **B.Sc. Second Year: Semester IV**

**COURSE CODE: B180401T**

**COURSE TITLE: Database Management System Code:**

This program imparts knowledge on various fields of computers and information technology through teaching, interaction, practical's and multimedia aids. It shall be very useful to give an idea of upcoming technologies in the digital era of artificial intelligence. It is job oriented and fulfills the industry demands of the present scenario. Students would gain wide knowledge of following aspects:

1. Basic concepts of database management systems.
2. E-R diagrams
3. Design database.
4. security algorithms

After the completion of the course the students will be able to:

1. Understands the basic concepts of database management systems.
2. Design E-R diagrams for real world applications.
3. Formulate relational algebraic expressions using relational data models and languages.
4. Apply normalization transaction properties and concurrency control to design databases.
5. Analyze the security algorithms for database protection.

**COURSE CODE :( Practical)**

**COURSE TITLE: Database Management System Lab using MySQL**

Ability to:

1. Understand, analyze and apply common SQL statements including DDL, DML and DCL statements to perform different operations.
2. Design and implement a database schema for a given problem.
3. Do connectivity of PHP and MySQL to develop applications.



## **DAYANAND GIRLS' P.G. COLLEGE, KANPUR**

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### **B.Sc. Third Year: Semester V**

**COURSE CODE: B180501T**

**COURSE TITLE: Web Technology**

CO1 Implement interactive web page(s) using HTML, CSS and JavaScript.

CO2 Design a responsive web site using HTML5 and CSS

CO3 Build Dynamic web site using server side PHP Programming and Database connectivity.

CO4 Describe and differentiate different Web Extensions and Web Services.

**COURSE CODE: B180601T**

**COURSE TITLE: Information Security & Cyber Laws Code**

After the completion of the course the students will be able to:

1. Understand types of information Systems, cyber threats, and national/international cyber security standards.
2. Do mathematical modeling and development of security techniques and information systems.
3. Develop understanding of legal issues related to cyber security.
4. Apply ethical principles/responsibilities in cyber practices.

**COURSE CODE:(Practical)**

**COURSE TITLE: Web Technology Lab**

CO 1: Understand and evaluate web application architecture, technologies and frameworks

CO 2: Apply the knowledge of web technology in developing web applications

CO 3: Evaluate different solutions in field of web application development

CO 4: implement small to large scale project to provide live solution in web application development fields



## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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### **B.Sc. Third Year: Semester VI**

**COURSE CODE: B180701T**

**COURSE TITLE: E-Commerce**

1. Understand the basic concepts and technologies used in the field of E-Commerce
2. Understand the processes of developing and implementing information systems
3. Be aware of the ethical, social, and security issues of information systems and
4. To apply their computer science skills to the conduct of e-commerce with some understanding of the legal, security, commercial, economic, marketing and infrastructure issues involved
- 5.

**COURSE CODE: B180801T**

**COURSE TITLE: Introduction to AI and Data Science**

1. Ability to learn and understand AI and Data Science basics
2. Ability to learn and understand machine learning basics and neural network

**COURSE CODE :( Practical)**

**COURSE TITLE: Lab on developing AI models using Python**

1. Ability to learn and understand AI models
2. Ability to learn and understand developing AI models using Python

### **Research Project for V and VI Semester**

- To facilitate the student to independently formulate and solve a social, philosophical, commercial, or technological problem and present the results in written and oral form.
- To render students to real life problems.
- To provide opportunities to students to interact with people and present them confidently.





# DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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## Department of Microbiology

### Preamble –

Microbiology is the study of organisms (most of which are too small to be seen with the naked eyes), their interactions with humans, plants, and the environment, and their application. These microorganisms have vital significance in human development as they can be exploited for several beneficial aspects while many cause devastating damage and sufferings affecting health and causing destruction.

The postgraduate course has been developed under the Learning Outcome Curriculum Framework under the recommendations and guidance of UGC. M.Sc. Microbiology program is a two-year duration with 4 semester system. There are 4 compulsory theory courses and one practical course offered in each semester.

## M.Sc. (MICROBIOLOGY)

### PROGRAMME OUTCOMES (POs)

1. **Domain knowledge:** demonstrate knowledge of basic concepts, principles and applications of specific science discipline.
2. **Resource utilization:** cultivate skills to acquire and use appropriate learning resources including library, e-learning resources, ICT tools to enhance knowledge based and stay abreast of recent developments.
3. **Analytical and Technical Skills:** Ability to handle/use appropriate tools/techniques/equipment with an understanding the standard operating procedure, safety aspects/limitations
4. **Critical thinking and problem solving:** Identify and critically analyse problems in discipline with appropriate tools/techniques/approaches to arrive at viable conclusions/solutions.
5. **Effective Communications:** Communicate effectively in spoken and written forms. Demonstrate ability to make presentations, write reports, dissertations etc.
6. **Environment and Society:** Analyse impact of scientific and technological advances on environment and society and need for sustainable development.
7. **Project Management:** Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies.



## DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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### **Program Specific Outcomes:**

At the end of this course the students will be able to apply the knowledge and skill based microbiological training for addressing research problems related to any discipline. Demonstrate knowledge and understanding of microbiological problems and solve scientific and technological issues. Students will be able to learn desired microbiological techniques through research project training and perform duties as research fellows/ scientist/ microbiologist.

### **COURSE OUTCOMES (Cos)**

#### **M.Sc. First Year: Semester I**

**COURSE CODE: L040701T**

**COURSE TITLE: General Microbiology**

Upon successful completion of the course the students will be able to understand basic working principles in microbiology and have knowledge for differentiating different microbial forms. Students will be able to demonstrate theory and practical skills in microscopy and their handling techniques, know various culture media, physical and chemical growth requirements, growth cultivation, preservation and staining procedures. They will learn different distinguishing characteristics of microorganisms and their classification system.

**COURSE CODE: L040702T**

**COURSE TITLE: Biochemistry**

Students will be able to know the basic concept of life on the molecular level, chemical nature of biomolecules, its arrangement and interaction with other biomolecules. They will understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and their importance in biological systems. They will have learnt basic concept of enzyme biochemistry, its kinetics and regulation, importance of high energy compounds, electron transport chain, and synthesis of ATP under aerobic and anaerobic conditions, central metabolic pathways for carbon metabolism in bacteria enlisting differences with eukaryotic systems and their regulation in diverse physiological conditions.



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**COURSE CODE: L040703T**

**COURSE TITLE: Analytical Techniques & Biostatistics**

Upon successful completion of the course the students will be able to carry out the gel electrophoresis, different chromatographic techniques like TLC, HPLC, Affinity chromatography, different centrifugation techniques, spectroscopic techniques like NMR, ESR, CD and Fluorescence experiments to monitor the stability of the protein. Students should follow the safety precautions while using radioactive methods, measurement of radioactivity. Students will also be able to understand statistical tools.

**COURSE CODE: L040704T**

**COURSE TITLE: Cellular Microbiology**

In cellular microbiology, students will be able to know basic structural and functional aspects and organization of living cells, understand the difference between prokaryotic and eukaryotic cells, different cell division, cell cycle. They will be able to infer which protein and pathways can be affected in abnormal/ cancer or normal cells. They will understand the different signal transduction pathways and their functions in cell regulation.

**COURSE CODE: L040705P**

**COURSE TITLE: Practical: Analytical and Microbial Techniques**

Upon successful completion students should be able to use different sterilization procedures and learn handling of micro pipette, able to work in bio safety cabinets for culturing cells, and perform a variety of cultural, biochemical tests. They will be able to use microscopy for cell imaging, various techniques like pH metry, chromatography, spectrophotometry and centrifugation.

### **M.Sc. First Year: Semester II**

**COURSE CODE: L040801T**

**COURSE TITLE: Bacterial Metabolism and Physiology**

Students will apply the knowledge to understand the microbial physiology and to identify the microorganisms and have gained an in-depth knowledge of the bacterial transport system, central metabolic pathways for carbon metabolism in bacteria and their regulation in diverse physiological conditions. They will be able to understand major fermentation, aerobic and anaerobic pathways for energy generation in microbial cells, and acquaint themselves with basics of metabolism and growth under normal and stressed conditions, and gain the knowledge of quorum sensing and multicellular organization of bacteria.



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**COURSE CODE: L040802T**

**COURSE TITLE: Fundamentals of Molecular Biology**

Upon successful completion of the course, the student is able to describe structures of DNA and RNA, organization of eukaryotic genome, compare and contrast the mechanisms of bacterial and eukaryotic DNA replication, DNA repair, transcription, able to explain various levels of gene regulation, describe post – transcriptional and translational processes, RNA editing. They will be able to explain concepts in DNA repair mechanisms and recombination at a molecular biology level.

**COURSE CODE: L040803T**

**COURSE TITLE: Recombinant DNA Technology**

Upon successful completion of the course students will know about basic principles of RDT, different restriction and modifying enzymes, library construction and screening, familiar with the use of various cloning vectors and purification of recombinant proteins. They will be able to describe the various methods of gene transfer in both plant and animal, able to understand nucleic acid labeling and hybridization techniques like southern, northern and western blotting. They will be aware that DNA is sequenced and will gain insights into how entire genomes of organisms are sequenced, the many uses of reporter genes and molecular markers, various applications of PCR, creation of plant and animal transgenics.

**COURSE CODE: L040804T**

**COURSE TITLE: Virology**

Upon successful completion of the course, the students will be able to know how viruses are classified and understand the architecture of viruses, the methods used in cultivation and assay of viruses, and understand general replication strategies of viruses including bacteriophages. They will be able to understand the structure, replication cycle and pathogenesis of selected plant and animal viruses, different antiviral mechanisms and recent applications in virology.

**COURSE CODE: L040806P**

**COURSE TITLE: Practical: RDT and Metabolism Techniques**

Upon successful completion of the course, the students will be able to understand the effect of various physiological conditions on growth. They can make qualitative and quantitative detection of different types of molecules, isolate and handle viruses, fungi and algae, and develop methods for isolating genomic DNA and plasmid DNA. They will be able to appraise restriction analysis of DNA, analyze the outcome of transformation.



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**COURSE CODE: L040807R**

**COURSE TITLE: Review writing presentation/ internship/ project**

Upon successful completion of the course, the students will be able to collect information of a given problem statement and compile it in sequential order and review notes to find main subdivisions (problems, possible solutions).

### **M.Sc. Second Year : Semester III**

**COURSE CODE: L040901T**

**COURSE TITLE: Microbial Genetics**

Upon successful completion of the course, the students can discuss the importance of mutation analysis, analyze mutations by complementation and recombination tests, and can design a strategy to create gene replacement in bacteria. They will be able to explain how plasmid copy number is regulated, can differentiate between Hfr strains and strains carrying F plasmid, and can construct a genetic map of bacterial genome using conjugation- based method, compare and contrast generalized versus specialized transduction, able to list the events in the lytic and lysogenic phases of lambda phage life cycle and the regulatory factors and events involved.

**COURSE CODE: L040902T**

**COURSE TITLE: Cellular and Molecular Immunology**

Upon completion of the paper, students will be able to distinguish between the specificity and memory of acquired versus innate immune response and different types of specific immune response. They will understand generation of immune diversity and different molecular aspects of immune response generation, immune techniques and their applications, how the immune response in vaccine development and immunotherapy.



## **DAYANAND GIRLS' P.G. COLLEGE, KANPUR**

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**COURSE CODE: L040903T**

**COURSE TITLE: Agriculture and Environment Microbiology**

Upon successful completion of the course, the students will have an overview of the till date development in the field of environmental microbiology with special emphasis on the role of microbes in mitigating environment pollution, will develop concepts of microbial diversity, community structure and role of microorganisms in biogeochemical cycles. They will be able to describe the role of soil microbes in nutrient transformation, plant-microbe interactions and biotechnology, understand the role of microorganisms in sustainable development and bioremediation of pollutants using microorganisms, understand the information about inter-relationship of soil and microorganisms, different group of beneficial microorganisms in agriculture, microbes as biofertilizers, plant pathogen and biocontrol agent.

**COURSE CODE: L040905T**

**COURSE TITLE: Extreme Microbiology**

Upon successful completion students should be able to know the types of microbial diversity that flourish in extreme environments, understand how organisms cope under extreme living conditions with biochemical and molecular adaptation of extremophilic microorganisms. They will understand modern techniques used for exploration of unculturable extremophiles, and also understand potential application of extremozymes in various industries and in functional genomics.

**COURSE CODE: L040908P**

**COURSE TITLE: Practicals**

Upon successful completion students should be able to demonstrate an understanding of the concepts of microbial genetics, use the properties of microorganisms, principally bacteria, as bioindicators of contamination and to remedy problems of contamination and other environmental impacts, deal with plant-associated microbes and to combat diseases that attack important food crops. They will evaluate extremophiles for beneficial characteristics, use basic methods and research tools applied in host-microbe interactions, design and present results of immunotechniques-based experiments.



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### **M.Sc. Second Year: Semester III**

**COURSE CODE: L041001T**

**COURSE TITLE: Industrial Microbiology**

Upon successful completion students will have gained insight on industrially important microbes, attain knowledge of various fermentation optimization strategies, learn about the concepts of processes, instruments, management, quality etc. being used in industries to produce the products using microorganisms. They will also gain knowledge about upstream and downstream processes in a fermentation process, and acquire knowledge about the production process of various industrially relevant microbial products.

**COURSE CODE: L041002T**

**COURSE TITLE: Medical Microbiology**

Students will have gained insight on medically important microbial pathogens, attain knowledge of various micropathogenicity strategies and antimicrobial resistance mechanisms. They will also learn about the different bacterial diseases and their causative agents and their pathogenesis mechanisms, gain knowledge about fungal and viral diseases and their pathogenesis mechanisms and understand the role of zoonotic infections and emerging infectious diseases.

**COURSE CODE: L041003T**

**COURSE TITLE: Food Microbiology**

Upon successful completion of the course, the students will know about traditional food preservation techniques including drying, salting, pickling refrigeration, freezing, oxidation, vacuum packaging, canning/ bottling, smoking, sugaring. They will gain knowledge about chemical preservation and irradiation, extrinsic and intrinsic factors of microbial growth, food intoxications and food borne infections, microbial standard for food safety, quality assurance programs and the use and production of probiotics and prebiotics. They will know about microbiology of milk and production and evaluation of the quality of starter cultures and fermented milk products such as yogurt, cheese etc.



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**COURSE CODE: L041005T**

**COURSE TITLE: Pharmaceutical Microbiology**

Upon successful completion students should be able to identify different antimicrobial agents and its mode of action. They will know the process involved in drug discovery and development, regulatory guidelines in pharmaceutical products, understand the production process of antibiotic development. They will also develop understanding of types and synthesis of antimicrobial agents, and learn about regulatory bodies associated with developing pharmaceutical products.

**COURSE CODE: L041009P**

**COURSE TITLE: Practical**

Upon successful completion students should be able to demonstrate and employ practical skills with both classical and modern laboratory techniques including trouble-shooting and problem solving in:

- a. Clinical chemistry
- b. Industrial and Medical microbiology
- c. Immunology
- d. Food and Pharma industry

They will also be able to design and present results of a immunotechniques- based experiment and effectively communicate laboratory findings, methodologies and strategies to both specialist and non-specialist audiences.

**COURSE CODE: L041010R**

**COURSE TITLE: Research project/Dissertation/Industry training/Survey**

Upon successful completion students should be able to list the objectives and state the hypothesis of the research project, outline the methodology that will be followed to achieve the listed objectives, employ the finalized methodology to solve the problem which has been undertaken. They will also be able to evaluate the data – accuracy and precision, sources of errors, specificity, sensitivity and detection limits, regression analysis, reporting results and organize the inferences to prove the hypothesis.





# DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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## Department of Mathematics

### B.Sc. (Mathematics)

#### PROGRAMME OUTCOMES (POs)

After the completion of programme, the students will be able-

1. To formulate, analyze, and solve problems through application of fundamental mathematical techniques
2. To develop the ability to determine the validity of a given argument, develop mathematical thinking and be able to solve mathematical problems and construct mathematical proofs independently.
3. To demonstrate an understanding of the foundations of various branches of mathematics and apply the same to formulate and develop mathematical arguments in a logical manner.
4. Apply knowledge and mathematical skills to translate information presented into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
5. Investigate and apply mathematical solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods.
6. Build a solid foundation for higher studies in mathematics and other disciplines requiring quantitative techniques and enhancing their career prospects through success in competitive examinations for further academic progression or placement in various positions requiring mathematical or quantitative background as a prerequisite
7. Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.



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### COURSE OUTCOMES (COs)

#### **B.Sc. First Year: Semester I**

**COURSE CODE: B030101T**

**COURSE TITLE: Differential Calculus & Integral Calculus**

After doing this course, students will gain knowledge on the following points.

1. Get knowledge of curvature, asymptotes, envelopes and evolutes.
2. Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference.
3. Apply derivatives in Optimization, Social sciences, Physics and Life sciences etc.
4. Know the concepts of calculus, namely, limits, continuity, differentiability of functions of one and two variables and their applications in the form of mean value theorem and Taylor's theorem.
5. Some of the families and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
6. Beta and Gamma functions and their properties.

**COURSE CODE: B030102P**

**COURSE TITLE: Practical**

The main objective of the course is to equip the student to plot the different graph and solve the different types of equations by plotting the graph using different computer software such as Mathematica /MATLAB/Maple /Scilab/Maxima etc.

#### **B.Sc. First Year: Semester II**

**COURSE CODE: B030201T**

**COURSE TITLE: Matrices and Differential Equations & Geometry**

After doing this course, students will gain knowledge on the following points.

1. Find the rank and eigenvalues of matrices.
2. Study the system of linear homogeneous and non-homogeneous equations.



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3. Formulate Differential Equations for various Mathematical models.
4. Solve first order nonlinear differential equations and linear differential equations of higher order using various techniques.
5. To learn and visualize the fundamental ideas of coordinate geometry.
6. To describe some surfaces by using analytical geometry.
7. To gain knowledge about regular geometrical figures and their properties.

### **B.Sc. Second Year: Semester III**

**COURSE CODE: B030301T**

**COURSE TITLE: Algebra & Mathematical Methods**

After doing this course, students will gain knowledge on the following points.

1. To develop mathematical skills in calculus and analysis.
2. To get knowledge of Laplace Transforms and Fourier series.
3. To get acquainted with the essentials of calculus of variations.
4. Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
5. Link the fundamental concepts of Groups and symmetrical figures.
6. Analyze the subgroups of cyclic groups.
7. Explain the significance of the notion of cosets, normal subgroups, and factor groups.
8. Understand the concepts of rings, subrings and fields.

### **B.Sc. Second Year: Semester IV**

**COURSE CODE: B030401T**

**COURSE TITLE: Differential Equation & Mechanics**

After doing this course, students will gain knowledge on the following points.

1. The significance of mathematics involved in physical quantities and their uses.
2. To understand the various concepts of basic mechanics like simple harmonic motion, motion under other laws and forces.
3. To study and to learn the cause-effect related to these. 4. The applications in observing and relating real situations/structures
4. Explain the foundations of various problems related to Wave, Laplace and Diffusion equations by the method of separation of variables.



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5. Deal with problems in applied mathematics, theoretical mechanics and mathematical physics and engineering.

### **B.Sc. Third Year: Semester V**

**COURSE CODE: B030501T**

**COURSE TITLE: Group and Ring Theory & Linear Algebra Theory**

After doing this course, students will gain knowledge on the following points.

1. The fundamental concept of Rings, Fields, subrings, integral domains and the corresponding morphisms.
2. The concept of linear independence of vectors over a field, the idea of basis and the dimension of a vector space.
3. Basic concepts of linear transformations, the Rank-Nullity Theorem, matrix of a linear transformation and the change of basis.
4. Automorphisms for constructing new groups from the given group.
5. Group actions, Sylow theorems and their applications to check non simplicity.
6. Compute inner products and determine orthogonality on vector spaces.

**COURSE CODE: B030502T**

**COURSE TITLE: Differential Geometry & Tensor Analysis**

After doing this course, students will gain knowledge on the following points.

1. Explain the concept of differential geometry.
2. Understand the concepts of tensors in differential geometry.
3. Apply various concepts of differential calculus in tensors.

### **B.Sc. Third Year: Semester VI**

**COURSE CODE: B030601T**

**COURSE TITLE: Metric Space & Complex Analysis**

After doing this course, students will gain knowledge on the following points.

1. Understand the basic concepts of metric spaces.
2. Know the concepts such as open balls, closed balls, compactness, connectedness etc.
3. Understand the significance of differentiability of complex valued functions leading to the understanding of Cauchy-Riemann equations.



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4. Evaluate the contour integrals and understand the role of CauchyGoursat theorem and the Cauchy integral formula.
5. Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

**COURSE CODE: B030602T**

**COURSE TITLE: Numerical Analysis & Operations Research**

After doing this course, students will gain knowledge on the following points.

1. Some numerical methods to find the zeros of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
2. Interpolation techniques to compute the values for a tabulated function at points not in the table.
3. Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.
4. Be able to understand the application of OR and frame a LP Problem with solution
5. Be able to build and solve Transportation and Assignment problems using appropriate methods.
6. Analyze and solve linear programming models of real-life situations.
7. The graphical solution of LPP with only two variables, and illustrate the concept of convex set and extreme points. The theory of the simplex method is developed.
8. The relationships between the primal and dual problems and their solutions with applications to transportation, assignment and two-person zero-sum game problem

**COURSE CODE: B030603P**

**COURSE TITLE: Practical**

Course outcomes: The main objective of the course is to equip the student to solve the transcendental and algebraic equations, system of linear equations, ordinary differential equations, Interpolation, Numerical Integration, Method of finding Eigenvalue by Power method (up to  $4 \times 4$ ), Fitting a Polynomial Function (up to third degree)



# DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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## Department of Physics

### B.Sc. (Physics)

#### **PROGRAMME OUTCOMES (POs)**

1. Graduates will demonstrate competence in their respective domain as they apply skills to conduct scientific research and contribute to quality education.
2. Graduates will be recognized as experts in educational and research institutes as well as industries in identifying and solving global challenges.
3. Graduates will become leading researchers and professors who create and disseminate new knowledge in scientific and allied fields.

#### **COURSE OUTCOMES (COs)**

##### **B.Sc. First Year: Semester I**

**COURSE CODE- B010101T**

**COURSE TITLE: Mathematical Physics & Newtonian Mechanics**

After doing this course, students will gain knowledge on the following points.

1. The students would clearly understand the conflict between Newtonian mechanics and Special Relativity and thus would know how the progress of the revolutionary scientific ideas is made through logical evidence and observations.
2. They would be able to understand the differences between inertial and non inertial frames and see how pseudo-forces arise in non-inertial frames.
3. They would have a clear understanding of the dynamics of conservative and non-conservative forces in real life such as in gravitational fields or mechanical systems having friction etc.
4. The students would clearly understand the basic concepts of mathematical physics and vector algebra.



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5. The primary objective is to teach the students basic mathematical methods that will be used in solving physical problems.

6. Students will learn the required mathematical techniques which will be useful in many other courses in higher education.

**COURSE CODE- B010102P**

**COURSE TITLE: Mechanical Properties of Matter**

After doing this course, students will gain knowledge on Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

### **B.Sc. First Year: Semester II**

**COURSE CODE- B010201T**

**COURSE TITLE: Thermal Physics & Semiconductor Devices**

After doing this course, students will gain knowledge on the following points.

1. The students will understand the fundamental principles of thermodynamics, including the first and second laws.
2. They would learn the idea of entropy and associated theorems, and the thermodynamic potentials and their physical meanings.
3. Students will have an understanding of Maxwell's thermodynamic relations.
4. They will acquire the knowledge about the fundamentals of gas kinetic theory and transport phenomenon.

**COURSE CODE- B010202P**

**COURSE TITLE: Thermal Properties of Matter & Electronic Circuits**

After doing this course, students will gain knowledge of the following experiments.

1. Characteristics of PN Junction diode
2. Characteristics of Zener diode
3. Characteristics of Light Emitting Diodes
4. Characteristics of Photo diode



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5. Characteristics of a PNP/NPN transistor CB configuration
6. Characteristics of a PNP/NPN transistor CE configuration
7. Characteristics of a PNP/NPN transistor CC configuration

### **B.Sc. Second Year: Semester III**

**COURSE CODE- B010301T**

**COURSE TITLE: Electromagnetic Theory & Modern Optics**

After doing this course, students will gain knowledge on the following points.

1. The student will get an introduction to the discipline of optics and its role in daily life.
2. The optics course will give the student a basic knowledge of interference, diffraction and polarization.
3. The student will be able to analyze and calculate interference between light waves and application of the theory to various interferometers along with their practical applications.
4. Comprehend and apply the understanding of fundamental laws and concepts in electricity and magnetism, primarily with regard to Maxwell's laws, to explain natural physical processes and related technological advancements.
5. Learn about the origin and basic properties of static as well as dynamic Electric and Magnetic fields, and the kinds of physical phenomena they generate - Electromagnetic waves and their properties.

**COURSE CODE- B010302P**

**COURSE TITLE: Demonstrative Aspects of Electricity & Magnetism**

After doing this course, students will gain knowledge of the following experiments.

1. Variation of magnetic field along the axis of single coil
2. Variation of magnetic field along the axis of Helmholtz coil

### **B.Sc. Second Year: Semester IV**

**COURSE CODE- B010401T**

**COURSE TITLE: Perspectives of Modern Physics & Basic Electronics**

After doing this course, students will gain knowledge on the following points.

1. Knowledge of Network theorems,





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2. Study the drift and diffusion of charge carriers in a semiconductor.
3. Study of special diodes
4. Study of the working, properties and uses of FETs and MOSFET
5. Comprehend the design and operations of SCRs and UJT.

**COURSE CODE- B010402P**

**COURSE TITLE: Basic Electronics Instrumentation**

After doing this course, students will gain knowledge on basic Electronics instrumentation which has the most striking impact on the industry wherever the components/instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments.

### **B.Sc. Third Year: Semester V**

**COURSE CODE- B010501T**

**COURSE TITLE: Classical & Statistical Mechanics**

After doing this course, students will gain knowledge on the following points.

1. Understand the concepts of generalized coordinates and D'Alembert's principle.
2. Understand the Lagrangian dynamics and the importance of cyclic coordinates.
3. Comprehend the difference between Lagrangian and Hamiltonian dynamics.
4. Recognize the difference between macrostate and microstate.
5. Comprehend the concept of ensembles and partition function.
6. Applications of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distribution laws.

**COURSE CODE- B010502T**

**COURSE TITLE: Quantum Mechanics & Spectroscopy**

After doing this course, students will gain knowledge on the following points.

1. It will help students understand the basics concepts of Quantum Physics.
2. It will make students understand the development of quantum mechanics as a continuity of classical concepts and also as a leap jump from classical to quantum world of Physics.
3. A student will be able to understand as to how the inadequacies of classical Physics were overcome by various concepts and theoretical developments of modern Physics i.e. understand



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how major concepts developed and changed over time.

4. A study of the Heisenberg's Uncertainty principle and its applications will make students understand the most modern concept of wave particle duality as to how a wave could behave like a particle and how a particle could behave like a wave.

5. After completion of the course students will be able to understand the spectra produced by one and two valence electron systems, intensity of spectral lines and effect of magnetic field on one electron systems as well as origin of hyperfine structure.

### **COURSE CODE- B010503P**

#### **COURSE TITLE: Demonstrative Aspects of Optics & Lasers**

After doing this course, students will gain knowledge of the following experiments.

1. Fresnel Biprism: Wavelength of sodium light
2. Newton's Rings: Wavelength of sodium light
3. Plane Diffraction Grating: Resolving power
4. Resolving power of telescope

### **B.Sc. Third Year: Semester VI**

#### **COURSE CODE- B010601T**

#### **COURSE TITLE: Solid State & Nuclear Physics**

After doing this course, students will gain knowledge on the following points.

1. Grasp the knowledge about basic nuclear properties and nuclear models for a better understanding of nuclear reaction dynamics.
2. Analyze quantum mechanical phenomena in nuclear physics and develop an understanding of quantum mechanics also.
3. Comprehend the general understanding of phenomena like nuclear fusion and fission and develop the skills required for solving basic problems in nuclear physics at different nuclear energy ranges.
4. Develop the basic understanding of accelerator physics and particle detectors.

#### **COURSE CODE- B010602T**

#### **COURSE TITLE: Analog & Digital Principles & Applications**

After doing this course, students will gain knowledge on the following points.



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1. Study the drift and diffusion of charge carriers in a semiconductor.
2. Understand the Two-Port model of a transistor.
3. Study the working, properties and uses of FETs.
4. Comprehend the design and operations of SCRs and UJTs.

**COURSE CODE- B010603P**

**COURSE TITLE: Analog & Digital Circuits**

Analog & digital circuits have the most striking impact on the industry wherever the electronics instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.



# DAYANAND GIRLS' P.G. COLLEGE, KANPUR

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## Department of Zoology B.Sc. (Zoology)

### PROGRAMME OUTCOMES (POs)

1. The programme has been designed in such a way so that the students get the flavour of both classical and modern aspects of Zoology/Animal Sciences. It aims to enable the students to study animal diversity in the Indian subcontinent, environmental science and behavioral ecology.
2. The modern areas including cell biology and genetics, molecular biology, biochemistry, physiology followed by biostatistics, Evolutionary biology, bioinformatics and genetic engineering have been included to make the study of animals more interesting and relevant to human studies which is the requirement in recent times.
3. The lab courses have been designed in such a way that students will be trained to join public or private labs, diagnostics and Pathology labs with good hands-on training. It will also enable students to take up higher studies and Research as their career and work.
4. The Degree courses will enable students to go for higher studies like Masters and Ph.D in Zoology and Allied subjects.
- 5.

### COURSE OUTCOMES (COs)

#### *Certificate Course in Medicinal Diagnostics & Public Health*

#### **B.Sc. First Year: Semester I**

**COURSE CODE: B050101T**

**COURSE TITLE: Cytology Genetics and Infectious Diseases**

- To understand the structure and function of all the cell organelles.
- To know how one cell communicates with its neighboring cells?
- To understand Mendel's laws and the deviations from conventional patterns of inheritance.
- To detect chromosomal aberrations in humans and study the pattern of inheritance by pedigree analysis in families.



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### **B,Sc. First Year: Semester II**

**COURSE CODE: B050102P**

**COURSE TITLE: Practical**

- Students will gain knowledge to make permanent slides of cell division.
- They will learn to prepare family pedigree.
- Students will be able to know about harmful parasites for animals and humans.

**COURSE CODE: B050201T**

**COURSE TITLE: Biochemistry and Physiology**

- To develop a deep understanding of the structure of biomolecules like proteins, lipids and carbohydrates.
- To understand the thermodynamics of enzyme catalyzed reactions.
- To understand systems biology and various functional components of an organism.
- To comprehend the regulatory mechanisms for maintenance of function in the body.

**COURSE CODE: B050202P**

**COURSE TITLE: Practical**

- To understand the various physiological processes through various instruments like hemoglobinometer, glucometer etc.
- To study various histological slides for better understanding of anatomy in chordates.
- Studying biochemistry through studying biochemical processes for tests for carbohydrates, lipids and proteins.



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### *Diploma in Molecular Diagnostics and Genetic Counseling*

#### **B.Sc. Second Year: Semester III**

**COURSE CODE: B050301T**

**COURSE TITLE: Molecular Biology, Bioinstrumentation & Biotechniques**

- A detailed and conceptual understanding of molecular processes viz. DNA to trait.
- Understanding of how genes are ultimately expressed as proteins which are responsible for the structure and function of all organisms.
- How genes are regulated differently at different times and places in prokaryotes and eukaryotes.

**COURSE CODE: B050302P**

**COURSE TITLE: Practical**

- Students will learn to identify various lab equipment needed for practical usage.
- They will learn to prepare solutions, buffers and working of instruments like spectrophotometer, chromatography and separation of tissue samples.

#### **B.Sc. Second Year: Semester IV**

**COURSE CODE: 8050401T**

**COURSE TITLE: Gene Technology, Immunology and Computational Biology**

- To know the applications of biotechnology in various fields like agriculture, industry and human health.
- To have an in-depth understanding about the Immune System & its mechanisms.
- Get introduced to computers and use of bioinformatics tools.
- Enable students to get employment in pathology/Hospital.

**COURSE CODE: 8050402P**

**COURSE TITLE: Practical**

- Students will learn to understand and apply statistical procedures involving Mean, median, mode, standard deviation.



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- Determination of blood groups and culture preparation for microbiological studies.
- To understand the basics of bioinformatics and computer application through BLAST, CLUSTALW.

### *Degree in Bachelor of Science*

#### **B.Sc. Third Year: Semester V**

**COURSE CODE: B050501T**

**COURSE TITLE: Diversity of Non-Chordates and Economic Zoology**

- To demonstrate comprehensive identification abilities of non-chordate diversity.
- To explain evolutionary relationships amongst non-chordate groups.
- Get employment in different applied sectors.
- Enable students to take up research in Biological Science.

**COURSE CODE: B050502T ANATOMY**

**COURSE TITLE: Diversity of Chordates and Comparative**

- To explain structural and functional diversity of chordates.
- To explain evolutionary relationships amongst chordates.

**COURSE CODE: B050503P**

**COURSE TITLE: Practical**

- To study various animal phyla through slides and specimens.
- To do dissections for understanding of anatomy of various phyla.
- To prepare permanent mounts of different body sections.
- To study life cycles of various invertebrate groups.



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### **B.Sc. Third Year: Semester VI**

**COURSE CODE: B050601T**

**COURSE TITLE: Evolutionary and Developmental Biology**

- Understand that by biological evolution we mean that many of the organisms that inhabit the earth today are different from those that inhabited it in the past.
- Understand how the single cell formed at fertilization forms an embryo and then a full adult organism.
- Integrate genetics, molecular biology, biochemistry, cell biology, anatomy and physiology during embryonic development.
- Understand how a cell behaves in response to an autonomous determinant or an external signal, and the scientific reasoning exhibited in experimental life science.

**COURSE CODE: B050602T**

**COURSE TITLE: Ecology, Ethology, environmental Science and Wildlife**

- Complexities and interconnectedness of various environmental levels and their functioning.
- Global environmental issues, their causes, consequences and amelioration.
- To understand and identify behaviour in a variety of taxa.
- Conceptualizing how species profitably inhabit the temporal environment and space out their activities at different times of the day and seasons. To understand the importance of wildlife conservation.

**COURSE CODE: B050603P**

**COURSE TITLE: Practical**

- To understand procedures utilized for demographic studies through survivorship curves and life tables.
- Understand Chrono Biology of animals and humans.
- To identify animals through their pug marks, hoofs, nests and antlers.





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### M.Sc. (ZOOLOGY)

#### PROGRAMME OUTCOMES (POs)

1. The student will have the knowledge of Biosystematics and evolutionary biology, cell biology and of student genetics. The programme has been framed to enhance the ability to operate various instruments for research methodology.
2. The programme has been designed in such a way so that a student is able to do a detailed research project in the first and second year of post-graduation. (First to fourth semester)
3. The research project will be done under a supervisor from the college teaching faculty. A Co-supervisor from any industry/technical institute/Research Institute can also be chosen.
4. The post graduation course will enable the students to go for higher studies in Ph.D. in Zoology. The student will be able to go for JRF and other research projects.

#### COURSE OUTCOMES (COs)

##### M.Sc. First Year: Semester I

**COURSE CODE: B050701T**

**COURSE TITLE: Non Chordata**

- Understand the various systems of non chordates.
- Evolution from simple to complex body organization.
- Salient features and affinities of different phylum's.

**COURSE CODE: B050702T**

**COURSE TITLE: Biosystematics and Evolutionary Biology**

- Understand the systematic position of various animals, taxonomic procedures.
- Evolution and adaptations.



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**COURSE CODE: B050703T**

**COURSE TITLE: Cell Biology and Genetics**

- Enable the student to understand the structure and function of all cell organelles.
- To understand the Mendel's law on their chromosomal basis, gene mapping, human pedigree, mutation. Course will also help to understand the concept of gene, gene and their regulation, Recombinant DNA technology etc.

**COURSE CODE: B050704T**

**COURSE TITLE: Quantitative biology Research Methodology and Bio-instrumentation.**

- Experimental Design, Data collection and their analysis by statistical tools and diagrammatic representation. To gain the knowledge about bio instruments for Research work will be prepared for laboratory work.
- Enable students to get employment in pathology, hospitals and research lab to test the ECG, CAT, FMRI, PET, MRI.
- Knowledge of Histochemical and immunotechniques will also help in higher studies.

**COURSE CODE: B050705P**

**COURSE TITLE: Practical**

- The students will learn to operate various instruments to enable them to work in pathology and research labs.
- They will learn to do Statistical analysis required for research work and projects

### **M.Sc. First Year: Semester II**

**COURSE CODE: B050801T**

**COURSE TITLE: Chordata**

- To demonstrate general characters, origin, organization, modification of organ in chordates.
- Explain evolutionary relationship among protochordates, hemichordates, urochordates.
- To gain the knowledge of cyclostomes and dipnoi.
- Origin of tetrapods, adaptive radiation of animals, modification of beaks, feet, gave emphasis on their development.
- Study of mammals also helps to understand the learning of human health.



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**COURSE CODE: B050802T**

**COURSE TITLE: Animal Physiology and Biochemistry.**

- Understanding of how the body is functioning.
- To understand endocrine system thermoregulation and other physiological activities of the body.
- To have an in-depth understanding about biochemical studies of enzymes and proteins.

**COURSE CODE: B050803T**

**COURSE TITLE: Reproductive and Developmental Biology**

- To understand the human reproductive system, Puberty.
- To know how the single cell formed at Fertilization and developed an adult organism.
- Awareness about reproductive health like STD, cancer, adenomyosis, UTI etc.

**COURSE CODE: B050804T**

**COURSE TITLE: Aaxua culture.**

- To gain knowledge about the culture of aquatic animals.
- Understanding the role of genetics in aquaculture.
- To study the environmental impact on aquatic animals.

**COURSE CODE: B050808P**

**COURSE TITLE: Practical**

- To understand and identify anatomical structures in lower chordates and chordates.
- To analyse physiological and biochemical processes through testing of blood samples.
- Understanding of functioning of instruments for blood parameter testing.
- To understand histology through sections and also developmental stages of different chordates through slides.
- Understanding of sampling patterns and various procedures adopted for aquaculture in terms of revenue generation.



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### **M.Sc. Second Year: Semester III**

**COURSE CODE: B050901T**

**COURSE TITLE: Ethology : Biodiversity and Wildlife conservation.**

- To understand the behavior of animals.
- To gain the identification knowledge of insects, fishes, birds and mammals.
- To study the management of wildlife sanctuaries/zoological parks etc.

**COURSE CODE: B050902T**

**COURSE TITLE: Molecular biology, immunology and bioinformatics**

- To study and interpret the isolation of Genomic DNA, types of DNA.
- How to detect chromosomes, mitochondria and other histology of the organs.
- Students can get jobs in any pathological lab/research institute.

**COURSE CODE: B050903T**

**COURSE TITLE: Waste Management and sustainable development.**

- To gain the knowledge of waste management and recycling of E-waste.
- To help achieve the goal of sustainable development with awareness programs.
- Understand about solar energy, wind energy, corporation, Rain water harvesting and eco cities.

**COURSE CODE: B050907T**

**COURSE TITLE: Ichthyology**

- To gain the knowledge of Fish Farming, Preservation.
- To enhance the knowledge of Fish byproducts.
- How to identify fishes and their zoogeographic distribution.
- Students get to improve their knowledge in the field of teaching/research/several fields.

**COURSE CODE: B050911P**

**COURSE TITLE: Practical**

- Better understanding of biodiversity and to understand procedures for wildlife conservation.
- To understand bioinformatics through models.
- Basic processes utilized for molecular biological procedures.



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- Working knowledge of rainwater harvesting, recycling of plastic material and use of alternate energy sources for waste management and sustainable development.
- Practical knowledge regarding ichthyological structures through dissections and permanent mounting.
- Understanding procedures for using nets, and various diseases involved in applied fisheries.

### **M.Sc. Second Year: Semester IV**

**COURSE CODE: B5051001T**

**COURSE TITLE: Ecology and Toxicology**

- To get the knowledge about ecology and its relevance with human welfare and biological interaction
- How to solve the problems of environmental pollution with knowledge of greenhouse gasses, ozone, and consequences of climate changes.
- Knowledge of toxicology predicts what and how chemicals may cause harm and then shares that information to protect public health.

**COURSE CODE: B5051005T**

**COURSE TITLE: Biotechnology**

- Improving animal health, enhancing animal production, developing new animal medals, and conserving biodiversity.
- It will be useful for diagnosing, treating and preventing human disease such as cancer, diabetes, infectious disease, and genetic disorders.
- Developing Novel drugs, vaccines, therapies, for human diseases using recombinant DNA technology, gene therapy, monoclonal antibodies, and nanotechnology.

**COURSE CODE: B5051008T**

**COURSE TITLE: Applied Ichthyology**

- They contribute to the conservation and management of fish resources, such as assessing fish stocks, monitoring fish health, and developing sustainable fisheries practices.
- They provide insights into the ecology and evolution of fish, such as their adaptations, diversity, distribution, and behavior.
- They support the development and improvement of aquaculture, such as breeding,



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- nutrition, disease control, and biotechnology of fish and other aquatic organisms.
- They enhance the understanding and appreciation of fish and their role in the aquatic ecosystems, such as their ecosystem services, cultural values, and recreational benefits.

**COURSE CODE: B5051010T**

**COURSE TITLE: Applied Environmental Biology**

- They help us understand the diversity and adaptations of living organisms, such as plants, animals, fungi, and microorganisms.
- They reveal the ecological roles and functions of living organisms, such as nutrient cycling, decomposition, pollination, and symbiosis.
- They contribute to the conservation and management of natural resources, such as biodiversity, water, soil, and air.
- They support the development and improvement of human well-being, such as food security, health, and livelihoods.
- Environmental biology is an important and interdisciplinary field that requires collaboration among researchers, practitioners, policy makers, and stakeholders. It is also a fascinating and rewarding field for those who are interested in the natural world and its wonders.

**COURSE CODE: B5051012P**

**COURSE TITLE: Practical**

- To understand the application of Ichthyology in day-to-day life.
- Understanding of fishing gears and nets.
- Full understanding of anatomy and physiology of fishes.
- Various cultivable models of fishes and their identification features.

**COURSE CODE: B051013R**

**COURSE TITLE: Research Project**

- By undertaking research projects, the students will learn about research methodologies, including experimental design, data collection, analysis, and interpretation, as well as literature review and citation.