

# SHRI GURU RAM RAI UNIVERSITY



**School of Basic &  
Applied Sciences**

**PO,CO,PSO  
AND  
PEO BOOKLET**

# SHRI GURU RAM RAI UNIVERSITY



## SCHOOL OF BASIC & APPLIED SCIENCES







**SHRI GURU RAM RAI UNIVERSITY**  
(Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017)  
**PATEL NAGAR, DEHRADUN-248001, UTTARAKHAND**

**MASTER OF SCIENCE (ZOOLOGY)**

**Programme outcomes (POs)**

<b>PO 1</b>	Implement strong theoretical and practical knowledge of biological science to solve complex scientific problems.
<b>PO2</b>	Problem Analysis: Identify the situation-based problem, formulation and action is taken based on analytical thinking and principles of science.
<b>PO3</b>	Execute effective communication through interactive and presenting skills, technical report writing and proper documentation of ideas.
<b>PO4</b>	Formulate, design, experimental techniques, scientific tools, analysis of scientific data, interpretation of data and establish a hypothesis for various interdisciplinary research problem.
<b>PO5</b>	Create a new conceptual, theoretical and operational approach to address various problem of interdisciplinary fields.
<b>PO6</b>	Enables individuals to function effectively in cross-cultural environment as an individual and as a member or leader.
<b>PO7</b>	Understand ethical issues, academic and research ethics, need and value of adding, learning, scientific misconduct of a scientist to serve society.
<b>PO8</b>	Understand the contribution of scientific knowledge in environmental sciences for sustainable development.
<b>PO9</b>	Enhance and adopt employability skills through research, internship and dissertation.
<b>PO10</b>	Successfully compete in the state level, national level and international level exam or competition.
<b>PO11</b>	Understands the complex evolutionary processes and behavior of animals.
<b>PO12</b>	Understanding of environmental conservation processes and its importance, pollution control and biodiversity and protection of endangered species.

**Program Specific Outcome (PSO)**

<b>PSO 1</b>	Understand the nature and basic concepts of cell biology, genetics, molecular biology, developmental biology, taxonomy, physiology, ecology & wild life and applied zoology, etc.
<b>PSO2</b>	Employ experimental skills for multi-disciplinary research work.
<b>PSO3</b>	Understand the applications of biological sciences in Apiculture, Sericulture, Aquaculture, Agriculture and Medicines.
<b>PSO4</b>	Gain knowledge about research methodologies, effective communication and skills.

**Course Outcome (CO)**

Course Code	Course Name	Outcome
MZOC101	Cell biology & genetics	<p><b>CO1</b> Remember about cell structure, cell organelles, cell cycle, Mendelian law, chromosomes and gene mutation.</p> <p><b>CO2</b> To understand the Mendel's law and the deviations from conventional patterns of inheritance. Structural and functional aspects of the basic unit of life i.e., cell concepts their structure and function.</p> <p><b>CO3</b> To show structural organization of all cell organelles, cell signaling, sex linked inheritance and genetic disorder.</p> <p><b>CO4</b> To analyze cell organelles composition, oncogene, tumour and apoptosis</p> <p><b>CO5</b> To evaluate/conclude the genetic disorder and mutation.</p> <p><b>CO6</b> To formulate numerical problem, Operon hypothesis and Hardi-Weinberg law.</p>
MZOC102	Lower Non-Chordata	<p><b>CO1</b> Remember structural and functional diversity of non-chordates and demonstrate comprehensive identification abilities of non- chordate diversity. Explain evolutionary relationship amongst non-chordate groups.</p> <p><b>CO2</b> Understand the diversity, origin of Metazoans, Classification and character of lower non chordates. life cycle of <i>Trypanosoma</i>, <i>Plasmodium</i>, <i>Giardia</i> etc.</p> <p><b>CO3</b> To construct a chart on origin and comparative morphology and system of Porifera and coelenterate</p> <p><b>CO4</b> To analyze the various aspects concerning the coelom, nutrition, locomotion, and reproduction of the Protozoa &amp; Porifera.</p> <p><b>CO5</b> Evaluating comparative morphology, reproduction, and phylogeny as well as affinities of Porifera and Coelenterata.</p> <p><b>CO6</b> To write about Helminthes parasites. Affinities of Ctenophora.</p>
MZOC103	Molecular biology, Evolution & systematics	<p><b>CO1</b> Remembering detailed and conceptual understanding of molecular processes, evolution and systematics.</p> <p><b>CO2</b> Understanding the various processes of molecular, evolution and systematics.</p> <p><b>CO3</b> Demonstrate the evolution and evolutionary theories. Life at molecular level, taxonomy and its principles</p> <p><b>CO4.</b> Compare and classify molecular theories, evolutionary outline &amp; theories and taxonomy</p> <p><b>CO5</b> Distinguish the role of mutation , Evolution and learn Geological time scale.</p> <p><b>CO6</b> To develop the Scope and history of animal taxonomy, molecular biology and evolution.</p>
MZOC104	Computer application, Biostatistics	<p><b>CO1</b> Identify the problem-solving methods, various tools &amp; techniques, using knowledge of computer used in</p>



	and Tools & Techniques in Biology	<p><b>CO2</b> biological systems and research.</p> <p><b>CO2</b> Discuss about the SOP of various instruments, analytical tools, and computer knowledge to solve various biostatistical problem.</p> <p><b>CO3</b> Demonstrate the significance of hypothesis testing and inferential statistics by using instrumental techniques and computer.</p> <p><b>CO4</b> Analyze the real-world problem using statistical tools and computer software, and reaching them to a solution.</p> <p><b>CO5</b> Conclude the principle and applications of various instrumental techniques like Microscopy, Colorimetry, Centrifuge, Chromatography, Spectrophotometer etc.</p> <p><b>CO6</b> Formulate and devise a plan to Develop skill of solving biological problem using a combination of Biostatistics, computer tools &amp; its techniques.</p>
<b>MZOL105</b>	<b>Lab Course – I</b>	<p><b>CO1</b> Observe the cell, cell organelles, and their functions.</p> <p><b>CO2</b> Understand the various phases of the cell cycle.</p> <p><b>CO3</b> To explain and solve the problems related to the principle and laws of Mendelian /modern genetics.</p> <p><b>CO4</b> To evaluate, identify and classification/taxonomic study of various specimens of lower non-chordates.</p> <p><b>CO5</b> Evaluate the various permanent slides of lower non-chordates and study of the life cycle of various lower non-chordates</p> <p><b>CO6</b> To prepare the life cycle of lower non-chordata by chart.</p>
<b>MZOL106</b>	<b>Lab Course-II</b>	<p><b>CO1</b> Describe the DNA structure and its components, RNA and its type.</p> <p><b>CO2</b> Understand the DNA repair systems along with their diagram, evolutionary theories, etc.</p> <p><b>CO3</b> Apply and discuss the computer and its accessories.</p> <p><b>CO4</b> Categorize the various equipment and their use in biology.</p> <p><b>CO5</b> Evaluate the application of various statistical methods/tools in biological Sciences.</p> <p><b>CO6</b> Revise the study of various instruments/tools in biological science.</p>
<b>MZOC201</b>	<b>Biotechnology and Microbiology</b>	<p><b>CO1</b> Remember all biotechnological and microbiological techniques in prospect of gene cloning, gene therapy, DNA fingerprinting, culture techniques and fermentation.</p> <p><b>CO2</b> To understand basic concept of Biotechnology, scope, and importance.</p> <p><b>CO3</b> To apply gene cloning, blotting techniques, PCR, gene therapy, DNA fingerprinting, Transgenic plant and transgenic animals' techniques in various fields.</p> <p><b>CO4</b> To analyze various microbial &amp; biotechnological techniques, fermentation &amp; processing.</p> <p><b>CO5</b> Compare and summarize culture techniques and gene cloning &amp; microbial culture technique application.</p> <p><b>CO6</b> To construct Microbial culture techniques &amp; analyze the laboratory facilities used in microbiology</p>

MZOC202	Higher Non-Chordata	<p><b>CO1</b> Remember about animals, their behaviour &amp; significance.</p> <p><b>CO2</b> To understand the organization and affinities minor Phyla.</p> <p><b>CO3</b> Demonstrate the comparative morphology of various classes, coelom, excretory organ and adaptive radiation in Polychaeta.</p> <p><b>CO4</b> Analyze the Appendages, Mouthparts, larval forms and affinities of Arthropoda &amp; Arthropoda &amp; another group of higher non-Chordata.</p> <p><b>CO5</b> Evaluate the comparative morphology, respiratory and reproductive system of Mollusca.</p> <p><b>CO6</b> Compare the Larval forms and affinities of Echinodermata and Mollusca.</p>
MZOC203	Animal Physiology and Toxicology	<p><b>CO1</b> Identify the various organ system based on their characteristics and the mechanism of absorption in animal world.</p> <p><b>CO2</b> Understand the functioning of various components of organ system found in animal world and its effect due to substrate toxicants.</p> <p><b>CO3</b> To demonstrate the various aspects of the animal physiology, its hormonal regulation &amp; their function's.</p> <p><b>CO4</b> Analyze the animal's physiology of organ systems and their regulation.</p> <p><b>CO5</b> Critique and conclude the morphological changes among the organs.</p> <p><b>CO6</b> Formulate and combine the modification within the organ system after exposure to toxins, duration &amp; frequency of exposure.</p>
MZOC-204	Developmental Biology	<p><b>CO1</b> Remember basic concepts of developmental biology and organogenesis.</p> <p><b>CO2</b> To explain the basic concept of development and gamete formation.</p> <p><b>CO3</b> To construct the various aspects concerning the early development</p> <p><b>CO4</b> Analyze the concept of cellular differentiation, organizer and embryonic inductions and eye morphogenesis.</p> <p><b>CO5</b> To conclude the various stages of development in drosophila and sex determination in vertebrates and flies.</p> <p><b>CO6</b> To develop the process of metaplasia, Trans differentiation and Metamorphosis.</p>
MZOL205	Lab Course-I	<p><b>CO1</b> Remember the various microbial staining techniques</p> <p><b>CO2</b> Understanding of the various Microbial culture techniques &amp; media enrichment techniques</p> <p><b>CO3</b> Carry out the DNA isolation.</p> <p><b>CO4</b> Collection/Demonstration, identification, and classification/taxonomic study of various specimens of Higher non-chordates.</p> <p><b>CO5</b> To evaluate the permanent slides of the Higher non-chordates.</p> <p><b>CO6</b> Learn and study of the life cycle of various Higher non-chordates.</p>

<b>MZOL206</b>	<b>Lab Course-II</b>	<b>CO1</b> Remember the various serological and biochemical tests. <b>CO2</b> Understand the various toxicological tests. <b>CO3</b> Illustrate the permanent slides/ whole mount of the various developmental stages of chicks, Amphibians, Mammals, etc. <b>CO4</b> Analyze the various permanent slides/Mounts <b>CO5</b> Evaluate the biochemical test. <b>CO6</b> Construct new toxicological techniques.
MZOC301	Endocrinology and Animal Behaviour	<b>CO1</b> Remember about hormones and their physiological actions and Biosynthesis. Animal behaviour and communication. <b>CO2</b> Explain the concepts of endocrine systems, homeostasis and their physiological actions of various hormones. <b>CO3</b> To show the metabolic pathways of hormones biosynthesis and mechanism of actions. <b>CO4</b> Analyze the evolution and various patterns of the behavioural in animals. Hormonal control of behaviour. <b>CO5</b> To evaluate the different modes of biological communication in animals. <b>CO6</b> Generate the knowledge about the hormonal and neural control of behaviour
MZOC302	Chordata	<b>CO1</b> Remember the basic concepts of chordata, their organization, distribution and adaptive radiation. <b>CO2</b> To discuss about classification, general organization, and affinities of Protochordata, Amphioxus and Urochordata, Agnatha. Understand the origin, General organization and affinities of Gymnophiona <b>CO3</b> To classify extinct reptiles & poisonous & non-poisonous snakes. Parental care in Amphibia. <b>CO4</b> To examine the flightless birds & migration in birds, adaptation in various chordate animals. <b>CO5</b> To evaluate the affinities, economic importance and adaptation from protochordates to mammals. <b>CO6</b> To assemble the adaptive radiation in Pisces, Reptiles, Aves and aquatic mammal.
MZOC303 (Elective-I, Any one)	General Ichthyology	<b>CO1</b> Remember the phylogeny, physiology, metamorphosis, fishery resources and fish behaviour. <b>CO2</b> Understand the systematics, Phylogeny and general organization of fishes. <b>CO3</b> To compile the general organization and affinities of Agnatha, Holocephali and Dipnoi. <b>CO4</b> Explain the culture systems and comparative Morphology metamorphosis of Teleost and Elasmobranchs. <b>CO5</b> To conclude the knowledge of physiology of alimentary canal electric organs and endocrine glands in fishes. <b>CO6</b> To develop the knowledge of physiology of respiration, sense organs, parental care and reproduction in fishes



MZOE304 (Elective-I, Any one)	Entomology-I	<p><b>CO1</b> Remember about the morphology &amp; concepts of overview of all orders of Entomology</p> <p><b>CO2</b> Understand the external morphology of insects (head, thorax, wings &amp; abdomen)</p> <p><b>CO3</b> To classify the insects Classification with special reference to that of different orders</p> <p><b>CO4</b> To analyze the general characters, habits, habitats, importance of the insect orders Embioptera, Orthoptera, Phasmida, Dermaptera, Blattaria, Menteodea, Isoptera, Zoraptera</p> <p><b>CO5</b> To generate the general characters, habits, habitats, importance of the insect order Psocoptera, Thysanoptera, Heteroptera, Homoptera, Anoplura, Neuroptera, Megaloptera, Trichoptera and reproductive system.</p> <p><b>CO6</b> To evaluate the general characters, habits, habitats, importance of the insect orders-Coleoptera, Strepsiptera, Hymenoptera, Lepidoptera, Diptera.</p>
MZOE305 (Elective-I, Any one)	Environmental Biology I	<p><b>CO1</b> Understand the concept of environmental biology, its multidisciplinary nature, scope, and its components.</p> <p><b>CO2</b> Knowledge about the terrestrial biomes of the world their characteristics and major biota</p> <p><b>CO3</b> Collect knowledge about environmental biology, Island biogeography, population cycle and biological control.</p> <p><b>CO4</b> Analyze the Population cycles and fluctuations. Succession model, Pioneer &amp; climax concept.</p> <p><b>CO5</b> Evaluate the concept of biological indicators, community pattern &amp; ecological Niche.</p> <p><b>CO6</b> Develop the techniques of biological control.</p>
MZOE306 (Elective-II, Any one)	Applied Ichthyology	<p><b>CO1</b> Remember about fish culture systems, Aquaculture fish behavior and disease.</p> <p><b>CO2</b> Understand the specialized characters, and endocrine system of fishes etc.</p> <p><b>CO3</b> Illustrate the knowledge about the development of fish, fish disease culture system etc.</p> <p><b>CO4</b> Analyze the Fish behaviour, fish breeding and hormonal control.</p> <p><b>CO5</b> Summarize the knowledge about Fish embryology, Fish disease, aquaculture (integrated aquaculture) systems,</p> <p><b>CO6</b> To assemble Endocrine system of fishes &amp; Cryopreservation and construction and maintenance of fish farm</p>
MZOE307 (Elective-II, Any one)	Entomology II	<p><b>CO1</b> Remember insects' physiology, growth, development and behaviour, metamorphosis and hormonal control. Hibernation &amp; aestivation,</p> <p><b>CO2</b> Understand the circulatory, respiratory &amp; sound and light producing organs</p> <p><b>CO3</b> Explain the digestive, excretory and reproductive system of insects.</p> <p><b>CO4</b> Focus on the structure of eye &amp; vision and metamorphosis in insects. Formation of germ layers &amp; development of insects.</p> <p><b>CO5</b> Evaluate the knowledge of about physiology of insects,</p>

		<b>CO6</b>	Pheromones and hormones & environmental factors. To develop the role of abiotic and biotic factors on the population and growth, social behaviour of the insects.
MZOE308 (Elective-II, Any one)	Environment Biology II	<b>CO1</b>	To Remember about natural resources, biodiversity and environmental problems
		<b>CO2</b>	Understand the Natural resources, their management & conservation
		<b>CO3</b>	Demonstrate the concept of protected areas, Biodiversity hot spots, and conventions on biodiversity.
		<b>CO4</b>	Analyze the International efforts in biodiversity conservation, deforestation, climate change and pollution.
		<b>CO5</b>	To evaluate the Global Environmental Problems
		<b>CO6</b>	To manage the Environmental Problems/Hazards in Hills.
MZOL309	Lab Course I	<b>CO1</b>	Observe the localization of different endocrine glands in the animals including humans.
		<b>CO2</b>	Discover various diseases caused by the malfunctioning of different endocrine glands in human beings.
		<b>CO3</b>	Examine the various permanent slides of different tissues/organs of the Chordates.
		<b>CO4</b>	Conclude the identification, and classification/taxonomic study of various specimens/Bones of the Chordates.
		<b>CO5</b>	Exercises/Case study based on animal behavior or /field Visits.
		<b>CO6</b>	Construct and study of permanent slides of the different body parts of the animals.
MZOL310	Lab Course II	<b>CO1</b>	Collection, identification, classification and preservation of different class of insects.
		<b>CO2</b>	Identification, classification, and general study of the various specimens of insects.
		<b>CO3</b>	Compile different types of wings, legs, stings, mouthparts etc. in insects.
		<b>CO4</b>	To examine various permanent slides of different organs and developmental stages, etc. in insects.
		<b>CO5</b>	To evaluate the life history of various insects.
		<b>CO6</b>	To assemble the diversity and distribution, behavioral aspects, and economic importance of insects through field trips/case study/experimental setup, etc.
MZOS311 (Self-study, any one)	Aquatic Biodiversity	<b>CO1</b>	Remember scope, concept of aquatic biodiversity and aquatic ecosystem and reservoirs.
		<b>CO2</b>	Understand Biodiversity definition, species concept, community & environmental projects.
		<b>CO3</b>	Apply Biodiversity scope and endemic species, hydrological projects.
		<b>CO4</b>	Analyze the type of ecosystem, biomes and their characteristics
		<b>CO5</b>	Evaluate the threats to habitats and biological diversity in Freshwater and marine ecosystems
		<b>CO6</b>	Formulate the impact of Impact of Hydroelectric Projects (HEP) on aquatic biodiversity, EIA, Environmental flaws.

MZOS312 (Self-study, any one)	Economic Zoology & Parasitology	<b>CO1</b> Remember about culture techniques, animal husbandry, IPM, parasitic protozoans and helminthes. <b>CO2</b> To understand the behaviour of fishes, insects and other parasitic protozoans and helminthes. <b>CO3</b> To analyze about the sericulture and life cycle of silk worm. Apiculture and fish culture system in India. <b>CO4</b> Analyzing poultry keeping & IPM <b>CO5</b> Evaluate parasitism and evolution of parasitism, protozoan parasite. <b>CO6</b> Generate the knowledge about parasitic adaptation in Platyhelminthes and Aschelminthes.
MZOS313 (Self-study, any one)	IPR, Patenting and Bioethics	<b>CO1</b> Identify the objectives, concept, applications and prospects of IPR, Patenting & Bioethics. <b>CO2</b> Demonstrate ability to utilize IPR, Patenting & Bioethics. <b>CO3</b> Exhibit an understanding of the concept and types of intellectual property rights and implementation of IPR in protecting biological inventions. <b>CO4</b> Comprehend various aspects of drafting of the patent application, types and specifications of the patent application, and various treaties and amendments made with exposure to the concept of international patenting. <b>CO5</b> Evaluate Social & ethical issues. <b>CO6</b> Invent new patent ideas, Industrial design and protection of GMOs
MZOC 401	Ecology and wild Life	<b>CO1</b> Remember ecological laws, Biogeochemical cycle, Ecosystem, Food chains and food web, Biosphere reserves, pollution, population, biodiversity and national park. <b>CO2</b> Understand the concept of population, Community, and succession <b>CO3</b> Applying knowledge about biodiversity & its importance <b>CO4</b> Analyze economic valuation of biodiversity, environmental pollution, wild life conservation. <b>CO5</b> Evaluate the techniques in wildlife, Population estimation. <b>CO6</b> Generate knowledge about Sanctuaries, National Parks, and Biosphere Reserves
MZOC 402	Immunology& Biochemistry	<b>CO1</b> Remember basic Biochemical & Immunological theories <b>CO2</b> Understand the concept immunity, antibody, antigen, and synthesis of biomolecules <b>CO3</b> Explain the biochemical & immunological concepts. <b>CO4</b> Compare and classify the immune system, immunity, immunoglobulins, biomolecules and enzymes. <b>CO5</b> Summarize and distinguish the immune system, types and biomolecules (metabolism) <b>CO6</b> To assemble the immunological & biomolecular techniques.



MZOE403 (Elective-I Any One)	Fisheries Science	<p><b>CO1</b> Remember of Aquaculture its scope and importance Culture systems. Fish culture in ponds and reservoirs, Culture in rice fields, fisheries, Cage culture, Pen culture, Monoculture polyculture</p> <p><b>CO2</b> Understand Preparation and maintenance of fish farm</p> <p><b>CO3</b> Applying induced breeding and its uses, biodiversity of fishes.</p> <p><b>CO4</b> Analyzing different culture practices, Recreational fishery and Cooperative movements</p> <p><b>CO5</b> Evaluate nature of various fishes like Mahseer, Schizothorax, fishery capture and ornamental fishery</p> <p><b>CO6</b> Create techniques of Fish preservation and processing techniques &amp; Nutritive value of fish.</p>
MZOE404 (Elective-I, Any One)	Applied Entomology	<p><b>CO1</b> Remember Insects in relation to man (Sericulture, apiculture, lac culture)</p> <p><b>CO2</b> Understand Brief knowledge of important household (Vegetable, store grain fruit pests with special reference to distribution, habits, habitat, nature of damage, life history and control)</p> <p><b>CO3</b> Applying different kinds of IPM techniques.</p> <p><b>CO4</b> Analyzing origin of pests and Insect pest control &amp; culture techniques.</p> <p><b>CO5</b> Evaluate Integrated Pest Management (IPM), Role of pheromones and hormones in insect pest management.</p> <p><b>CO6</b> Generate Environmental factors influencing effectiveness of insecticides.</p>
MZOE 405 (Elective-I, Any One)	Applied Environmental Biology	<p><b>CO1</b> Remember about Air pollution (Air pollutants) Water: Biochemical aspects of water pollutants, Waste water treatment, Water quality standards</p> <p><b>CO2</b> Understand Radioactive fallouts its effects &amp; safe disposal</p> <p><b>CO3</b> Applying Environmental Impact Assessment (EIA), IPM</p> <p><b>CO4</b> Analyze Ecological experimentation &amp; models</p> <p><b>CO5</b> Evaluate Analytical &amp; simulation models</p> <p><b>CO6</b> Generate various environmental parameters &amp; techniques to check environmental hazards.</p>
MZOE 406 (Elective-II, Any One)	Research Methodology in fishery science	<p><b>CO1</b> Remember Research and scientific methods, fish sampling &amp; preservation, diversity of fish fauna, statistical method &amp; analytical methods</p> <p><b>CO2</b> Understand Water Chemistry and substrate conditions</p> <p><b>CO3</b> Applying Importance of statistics in biological research &amp; in fisheries.</p> <p><b>CO4</b> Analyze Calculation and importance of Shannon Wiener Diversity Index &amp; other statistical methods</p> <p><b>CO5</b> Evaluate Cluster analysis, Factor analysis, Discriminate analysis. Calculation and importance of Shannon Wiener Diversity Index.</p> <p><b>CO6</b> Create new technological techniques in biological research.</p>

MZOE 407 (Elective-II, Any One)	Research Methodology in Entomology	<p><b>CO1</b> Remember research methodology in entomology, Role of entomology in agriculture</p> <p><b>CO2</b> Understanding entomological techniques, Type of sampling survey, Different Collection Methods Collection of wild flies and domestic insects, Insect Laboratory and rearing equipment</p> <p><b>CO3</b> Applying Entomological techniques, Trophic relationships, Use of ecological data, insect diversity, Indices, richness, Population estimates, Coexistence and Competition.</p> <p><b>CO4</b> Analyzing application of statistics in entomology, role of entomology in different fields &amp; insect diversity.</p> <p><b>CO5</b> Evaluating entomological techniques &amp; statistical techniques.</p> <p><b>CO6</b> Create new techniques in about population estimation, statistical methods etc.</p>
MZOE 408 (Elective-II, Any One)	Research Methodology in Environmental Biology	<p><b>CO1</b> Remember importance and need of environmental research, Field survey: Site selection.</p> <p><b>CO2</b> Understand Measurement of solar radiation wind velocity, air quality monitoring.</p> <p><b>CO3</b> Apply sampling methods for aquatic fauna and flora, Application of statistical Descriptive and regression analysis in Environmental Science.</p> <p><b>CO4</b> Analyze Water quality parameters, (velocity, depth, transparency, dissolved oxygen, free carbon dioxide, pH, turbidity, hardness, alkalinity, BOD, COD, Dissolved nutrients) &amp; sampling methods.</p> <p><b>CO5</b> Evaluate Sampling techniques &amp; statistical techniques.</p> <p><b>CO6</b> Create new techniques in about research &amp; environment.</p>
<b>MZOL409</b>	<b>Lab Course I Based on MZOC401 &amp; 402</b>	<p><b>CO1</b> Identify and observe the ecosystems ecology biodiversity biomolecules and immune system.</p> <p><b>CO2</b> Distinguish the ecosystem and immunological aspects.</p> <p><b>CO3</b> Examine the ecosystem and its trophic levels, biomolecules &amp; immunoglobulins, antigen, antibody presence.</p> <p><b>CO4</b> Diagrammatic representation of food chain food web, lymphoid organs etc.</p> <p><b>CO5</b> Biomolecular, immunological and bio stat tests in ecology.</p> <p><b>CO6</b> Recognize the presence of ecological biodiversity, and tests of antigen antibodies, biomolecules and blotting techniques.</p>
<b>MZOL410</b>	<b>Lab Course II Based on MZOE403 &amp; 406</b>	<p><b>CO1</b> Remember the ichthyology, fisheries, and research methodology terms</p> <p><b>CO2</b> Understand the application of basics of ichthyology, fisheries, and research methodology in experiments</p> <p><b>CO3</b> Apply the techniques for the fresh water ecology examination</p> <p><b>CO4</b> Analyze the various techniques and their effects for fresh water ecology and animals.</p> <p><b>CO5</b> Evaluate the fish experimentation techniques and their importance</p>

		<b>CO6</b>	Create and develop the diversity and distribution behavioral aspects and economic importance of fishes through field trips/case study experimental setup etc.
<b>Elective</b>	<b>MZOE411 Dissertation</b>	<b>CO1</b> <b>CO2</b> <b>CO3</b> <b>CO4</b> <b>CO5</b> <b>CO6</b>	Designing of research work/plan. Formulation of research methodology. Methods implementation. Gathering of research data. Application of statistics or statistical tools and software. Research result formulation and interpretation.



## MASTER OF SCIENCE (BOTANY)

### Programme outcome (POs)

The student will be able to:

<b>PO 1</b>	In depth understanding of operational aspects, principles and objectives of botany and Allied Sciences.
<b>PO2</b>	Understand ethical issues, academic and research ethics, the need and value of lifelong learning, and the scientific misconduct of a scientist to serve society.
<b>PO3</b>	Understand the contribution of scientific knowledge in environmental contexts for sustainable development.
<b>PO4</b>	Demonstrate the professional botanical solutions in societal and environmental contexts, with the knowledge and need for sustainable development
<b>PO5</b>	Identify the situation-based problems, formulation, and action is taken based on analytical thinking and principles of science
<b>PO6</b>	Execute effective communication through interactive and presenting skills, technical report writings, and proper documentation of ideas.
<b>PO7</b>	Formulate, design, experimental techniques, scientific tools, analysis of scientific data, interpretation of data, and establish a hypothesis for various interdisciplinary research problems.
<b>PO8</b>	Enables individuals to function effectively in cross-cultural environments as an individual, and as a member or leaders.
<b>PO9</b>	Enhance and adopt employability skills through research, internship, and dissertation.
<b>PO10</b>	Implement strong theoretical and practical knowledge of botany to solve complex scientific problems
<b>PO 11</b>	Create a new conceptual, theoretical and operational approach to address various problems in interdisciplinary fields
<b>PO12</b>	Generate a culture of life-long learning in an inclined environment to achieve personal and enhance their employability for jobs in different sectors

### Program Specific Outcome (PSOs)

<b>PSO 1</b>	Knowledge about the basics and advanced aspects of cryptogamic botany.
<b>PSO2</b>	Understand different specializations of botany such as systematics, evolution, ecology, developmental biology, physiology, biochemistry, plant interactions with microbes and insects, morphology, anatomy, reproduction, genetics, cell & molecular biology of various life-forms.
<b>PSO3</b>	Learn, think and apply suitable methods to solve a wide range of problems in various analytical techniques of plant biology, use of plants as industrial resources or as human livelihood support system, transgenic technologies for basic and applied research in plants.
<b>PSO4</b>	Identify various life forms of plants, design and execute experiments related to basic and applied studies.
<b>PSO 5</b>	Evaluating the efficiency of various technologies and developing entrepreneurial and job-oriented skills needed in research, consultancy, forest service and industry

**Course Outcomes (COs)**

<b>Course Code</b>	<b>Course Name</b>	<b>Outcome</b>
<b>MBOC 101</b>	<b>Mycology and Microbiology</b>	<b>CO1-</b> Recall the knowledge about the history, concept and scope of mycology & Microbiology. <b>CO2-</b> Understand the general characters and structural organization of Fungi and Microbes. <b>CO3-</b> Explain and think about the symptoms and causal organisms of various fungal diseases of plants. <b>CO4-</b> Analyze the importance of the characteristics, mode of reproduction and economic importance of Viruses and update the knowledge of basic of immunology. <b>CO5-</b> Summarized the basic concept of fungi and microbes borne diseases. <b>CO6-</b> Generalized the knowledge about the Mycology and Microbiology.
<b>MBOC 102</b>	<b>Phycology and Bryology</b>	<b>CO 1-</b> Remember to define various component of environment and ecosystem and taxonomic terminology <b>CO 2-</b> Understand to describe, discuss, distinguish and identify plants which belong to dicot and monocot families <b>CO 3-</b> Apply to explain the basic principles of classification of angiosperm plants. <b>CO 4-</b> Analyze to differentiate and explain structure and functions of ecosystem, food chain and food web. <b>CO5-</b> Evaluate to summarize, justify and select plant community and succession. <b>CO6-</b> Create to develop, write or construct Biogeochemical cycling in nature.
<b>MBOC- 103</b>	<b>Pteridology, Gymnosperm and Palaeobotany</b>	<b>CO1-</b> Remember the history, origin, classification of pteriphytes and Gymnosperms in India with special reference to Himalaya. <b>CO2-</b> Understand the history origin, classification, distribution, morphology and life history of Pterophyta and Fossil Pteridophyte. <b>CO3-</b> Explain Illustrate and design the morphology, structure and life history of and Gymnosperms and their economic importance. <b>CO4-</b> Analyze the scope of Pteridophyte, gymnosperms Paleobotany, types of fossils, its role in global economy and geological time scale. <b>CO5-</b> Summarized the history, origin, classification of pteridophytes and Gymnosperms. <b>CO6-</b> Express the knowledge related to Pteridophyte and gymnosperms.
<b>MBOC 104</b>	<b>Taxonomy and Diversity of flowering Plants</b>	<b>CO1-</b> Remembering the depth knowledge salient features of angiosperms, concept of origin and evolution of angiosperms. <b>CO2-</b> Understanding various systems of classifications and its salient features <b>CO3-</b> Familiarized with the salient features of ICBN/ICN species concept, taxonomic hierarchy, and delimitation of taxa and attribution of rank.

		<b>CO4-</b> Analyze the plants and describe them taxonomically <b>CO5-</b> Summarized the skills in Plant inventory and exploration, identification and its conservation <b>CO6-</b> Acquaint with basic concept of plant taxonomy with reference to flowering plants.
<b>MBOL 105</b>	<b>Laboratory Course-I</b>	<b>CO1-</b> Recall the knowledge of different genera belong to different classes of fungi, algae and bryophytes. <b>CO2-</b> Understanding about different instruments and lab safety rules. <b>CO3-</b> Illustrate the methods of isolation and identification. <b>CO4-</b> Analyze the agar plate technique for isolation, enumeration and identification of microbes. <b>CO5-</b> Reframe the identification and Isolation of fungi, Algae and Bryophytes. <b>CO6-</b> Assemble the knowledge of media preparation, Isolation and identification fungi, Algae and Bryophytes.
<b>MBOL 106</b>	<b>Laboratory Course-II</b>	<b>CO1-</b> Recall the knowledge of different genera belong to different classes and orders of Pteridophyte and Gymnosperms, Angiosperm and fossil plants. <b>CO2-</b> Gain Understanding about morphology of plants through live potted specimens. <b>CO3-</b> Apply the methods of identification with the help of keys and flora. <b>CO4-</b> Execute and apply the herbarium preparation and to enhance their knowledge regarding conservation of plants through field trips. <b>CO5-</b> Justify the knowledge of Pteridophyte and Gymnosperms, Angiosperm and fossil plants. <b>CO6-</b> Report preparation of Field trips, compilation of field notes, the preparation of museum specimens and/or live potted specimens of taxonomic interest and submission of the excursion report.
<b>MBOC 201</b>	<b>Plant Development and Reproductive Biology</b>	<b>CO1-</b> Remember the process of Plant Development and Reproductive Biology. <b>CO2-</b> Understand the organization and differentiation of shoot with reference to SAM and RAM, male and female gametophyte, ovule structure. <b>CO3-</b> Explain the reproduction process, Seed development and Fruit growth. <b>CO4-</b> Analyzed the differentiation and arrangement of leaf, shoot and root. <b>CO5-</b> Summarized the growth and development of root, shoot, leaf, seed. <b>CO6-</b> Generalized the developmental process and organization of plant reproductive organs.
<b>MBOC 202</b>	<b>Resource Utilization, IPR and Ethnobotany</b>	<b>CO1-</b> Remember and define the concepts of Plant resources its economic value and conservation <b>CO2-</b> Understand, describe and classify the diversity and uses of plants in different aspects <b>CO3-</b> Explain and Develop a basic knowledge of important families of useful plants.



		<p><b>CO4-</b> Analyze the concept of IPR, various legal issues related to IPR.</p> <p><b>CO5-</b> Summarized the concept of ethno-botany and folk medicines.</p> <p><b>CO6-</b> Generalized the basic concepts if Resource Utilization, Conservation and Ethnobotany.</p>
<b>MBOC 203</b>	<b>Cytogenetics and Molecular Biology</b>	<p><b>CO1-</b> Describe the Cytogenetics and molecular biology and pattern of inheritance in various life forms.</p> <p><b>CO2-</b> Understand the fundamental basics of cell structure, inheritance and genetics on molecular level.</p> <p><b>CO3-</b> Apply the knowledge about the plant cell structure and their turn over, starting from cell wall to chromatin, in relation to their functions and Genetics of prokaryotes and eukaryotic organelles.</p> <p><b>CO4-</b> Explain the principle mechanisms of genome replication, maintenance, function and regulation of expression, Genetic recombination and genetic mapping with reference to prokaryotes and eukaryotic organelles of cells.</p> <p><b>CO5-</b> Summarized the knowledge of Cytogenetics and molecular biology in designing experiment, statistical analysis, and interpretation of results.</p> <p><b>CO6-</b> Generalized the concept of Cytogenetics and molecular biology</p>
<b>MBOC 204</b>	<b>Plant Breeding and Biostatistics</b>	<p><b>CO1-</b> Recall the knowledge about the fundamental aspects of plant breeding and Biostatistics.</p> <p><b>CO2-</b> Understand the experimental steps and methods involved in generating new varieties using classical and contemporary breeding practices</p> <p><b>CO3-</b> Explain the maintenance, registration, production, testing, certification and distribution of seeds. Illustrate the methods of plant breeding.</p> <p><b>CO4-</b> Analyze the application of plant breeding and statistical methods to conduct research</p> <p><b>CO5-</b> Summarized knowledge of plant breeding techniques and formulation of Biostatistics.</p> <p><b>CO6-</b> Generalized the all concern area of plant breeding and Biostatistics.</p>
<b>MBOL 205</b>	<b>Laboratory Course-I</b>	<p><b>CO1-</b> Recall the effect of gravity, unilateral light and plant growth regulators on the growth of young seedlings.</p> <p><b>CO2-</b> Understand the role of dark and red-farred light on the expansion of cotyledons and epicotyls hook opening in pea.</p> <p><b>CO3-</b> Develop the cyto histological zones in the shoot apical meristem through preparing sectioned and double stained slides of various suitable plant species, such as <i>Coleus</i>, <i>Kalanchoe</i> and <i>Nicotiana</i>.</p> <p><b>CO4-</b> Illustrate the leaf arrangement through studying fresh specimens of various types.</p> <p><b>CO5-</b> Analyze the differences in the anatomy of C3 and C4 plants by making suitable preparation of leaves of various plants such as <i>Cannabis</i>, <i>Nicotiana</i>, <i>Zea</i></p>

		<p><i>maize</i> and <i>Triticum</i>.</p> <p><b>CO6-</b> Generalized the entire topic related to Plant anatomy, embryology, cytogenetics, resource utilization. Report preparation of Field trips, compilation of field notes, the preparation of museum specimens and/or live potted specimens of taxonomic interest and submission of the excursion report</p>
<b>MBOL 206</b>	<b>Laboratory Course-II</b>	<p><b>CO1-</b> Recall the various stages of mitotic and meiotic cell divisions.</p> <p><b>CO2-</b> Estimate the SDS-PAGE of chlorplastic proteins.</p> <p><b>CO3-</b> Prepare the restriction digestion of plant DNA and its separation using AGE and visualization by staining with EtBr</p> <p><b>CO4-</b> Illustrate southern, northern, western blotting and ELISA.</p> <p><b>CO5-</b> Evaluate the problems related to the Mendelian, post-Mendelian ratios, gene interactions, sex linked inheritance and chromosomal mapping.</p> <p><b>CO6-</b> Generalized and solve the normal practices of cytogenetics, molecular biology and plant breeding.</p>
<b>MBOC 301</b>	<b>Plant Physiology and Biochemistry</b>	<p><b>CO1-</b> Remember the concept of water potential, diffusion, osmosis and Imbibition, Energy flow, Biomolecules, photosynthesis, and metabolism, nitrogen fixation, translocation, Phytohormones and Sensory photobiology.</p> <p><b>CO2-</b> Understand the knowledge of water and translocation in plants with reference to metabolism and respiration.</p> <p><b>CO3-</b> Explain structure, composition and functional mechanisms of various biologically important molecules like carbohydrates, amino acids, proteins and lipids, photosynthesis, respiration and Phytohormones.</p> <p><b>CO4-</b> Analyze the knowledge about membrane transport and translocation of water and solutes.</p> <p><b>CO5-</b> Summarized the fundamentals and advanced aspects of water potential, photosynthesis, respiration and biomolecules metabolism and Phytohormones.</p> <p><b>CO6-</b> Create a general idea of plant physiology and biochemistry.</p>
<b>MBOC 302</b>	<b>Ecology and Remote Sensing</b>	<p><b>CO1-</b> Remember the concept of ecology, ecological dynamics and Application of remote sensing. Correlate ecological dynamics and regulation of vital processes on earth as biogeochemical cycles.</p> <p><b>CO2-</b> Understand the knowledge of ecology with reference to ecosystem, succession and biogeochemical cycles with the Application of remote sensing.</p> <p><b>CO3-</b> Explain ecosystem services, ecological resilience, ecological economics, and landscape ecology, soil profiling climate change and Remote Sensing.</p> <p><b>CO4-</b> Explain the concepts of Ecology and Remote Sensing.</p>

		<p><b>CO5-</b> Summarize the forces impacting ecosystems viz., climate change, stress, population, consumerism, globalization, land use change.</p> <p><b>CO6-</b> Generalized the fundamentals, and applications of remote sensing in ecological and forestry research.</p>
<b>MBOL 303</b>	<b>Laboratory Course-I</b>	<p><b>CO1-</b> Recall the knowledge of effect of the permeability of the cytoplasmic membrane, water potential osmosis photosynthesis.</p> <p><b>CO2-</b> Observe the Principles of colorimetry, spectrophotometry and flourimetry.</p> <p><b>CO3-</b> Illustrate the separation of chloroplast pigment and amino acids by paper and column chromatography.</p> <p><b>CO4-</b> Contrast and execute the minimum size and number of quadrats to be laid down in the field for the calculating the diversity indices.</p> <p><b>CO5-</b> Test the pH and the buffering properties of soils.</p> <p><b>CO6-</b> Solve the problem related to plant physiology, biochemistry and ecology.</p>
<b>MBOE 304</b>	<b>Palynology and Pollination Biology</b>	<p><b>CO1-</b> Recite the general concepts of palynology</p> <p><b>CO2-</b> Understand the structure and development of pollen wall development.</p> <p><b>CO3-</b> Examine the morphological features of Spore-pollen.</p> <p><b>CO4-</b> Analyze and identify the various aspects of Palynotaxonomy.</p> <p><b>CO5-</b> Summarized the importance of aeropalynology with reference to allergy.</p> <p><b>CO6-</b> Generalized the concepts Palynology and Pollination Biology</p>
<b>MBOE 305</b>	<b>Fresh water algal flora of Himalaya</b>	<p><b>CO1-</b> Recall the taxonomic keys for identifying different floral diversity in the Himalayan region.</p> <p><b>CO2-</b> Understand freshwater diatoms and their taxonomic terminology will be useful and will have a brief insight.</p> <p><b>CO3-</b> Examine floral diversity, which plays many important and beneficial roles in freshwater ecosystems of the Himalayan regions.</p> <p><b>CO4-</b> Compare characters of Green, blue-green algae and their taxonomic terminology</p> <p><b>CO5-</b> Summarized the Fresh water algal flora of Himalayan region.</p> <p><b>CO6-</b> Generalized the concept of Fresh water algal flora of Himalaya</p>
<b>MBOE 306</b>	<b>Plant Health Management</b>	<p><b>CO1-</b> Remember the terms associated with plant health management and basic procedure of diagnosis and significance of plant diseases.</p> <p><b>CO2-</b> Understand and Learn the concepts of seed pathology and Defence mechanism in plants.</p> <p><b>CO3-</b> Illustrate the important of plant diseases with reference to Nursery, cash crops.</p> <p><b>CO4-</b> Explain the important diseases of plantation.</p> <p><b>CO5-</b> Summarized the various types of Mycorrhizal associations and their role in forestry.</p>

		CO6-	Generalize and write the diseases of cereals, millets, vegetables and fruit trees.
<b>MBOE 307</b>	<b>Environment Microbiology</b>	CO1-	Remember the knowledge of Fundamentals of Microbial Ecology, Air and Aquatic Microbiology, Microbial Interactions, Pollution and Impact of Microbes on Environment
		CO2-	Understand the metabolic processes of microorganisms, principally bacteria, to industrial processes related to the environment.
		CO3-	Explain the Microbial Ecology.
		CO4-	Analyze design experiments and interpret results.
		CO5-	Summarized and use the properties of microorganisms, principally bacteria, to remedy problems of contamination and other environmental impacts.
		CO6-	Generalized the knowledge of Microbial Ecology.
<b>MBOL 308</b>	<b>Laboratory Course-II</b>	CO1-	Examine the pollen grains from honey samples and to study the frequency of different Morpho-types.
		CO2-	Distinguish the in vivo and in vitro germination of pollen grains.
		CO3-	Develop the Cultivation of algae of commercial importance
		CO4-	Analyze and Isolate some important plant pathogen.
		CO5-	Evaluate and Isolation of Fungi/bacteria by the Pour-plate method, Spread-pate and Streak Plate method.
		CO6-	Solve the problem related pollen morphology and ecology.
<b>MBOS 309</b>	<b>Forest Ecology</b>	CO1-	Describe the relationship of forests, forestry and man.
		CO2-	Understand the essential elements of forest ecology.
		CO3-	Apply the Comprehend the composition, structure, dynamics, growth and classification of forests and also about the factors affecting forests.
		CO4-	Explain about the various aspects of Wild Life in relation to Sanctuaries and Biosphere reserves.
		CO5-	Examine the essential components of forest conservancy and its potential productivity.
		CO6-	Generalized the term forestry.
<b>MBOS 310</b>	<b>Introduction to Medicinal and Aromatic Plants</b>	CO1-	Remember the Knowledge of medicinal and aromatic plants, their importance, and status and future prospects.
		CO2-	Understand the Good Agriculture Practices and Good Manufacturing Practices
		CO3-	Practice and conserve the medicinally important herbs
		CO4-	Explain aromatic plants used in different industries particularly Perfume industry.
		CO5-	Justify the role of agencies constituted for promotion of medicinal plant sector at national level.
		CO6-	Adapt the benefits of Medicinal and Aromatic Plants.
<b>MBOS 311</b>	<b>Pathogens and Pests of Crop Plants</b>	CO1-	Remember the basic fungal biology, taxonomy of the fungi and major fungal lineages
		CO2-	Understand the skills necessary to isolate and handle

		<p>fungi from nature, and to discern important microscopic characteristics of fungi.</p> <p><b>CO3-</b> Develop functional knowledge on differentiating disease caused by virus, fungi, and bacteria</p> <p><b>CO4-</b> Analyze the biology of major, and emerging pathogens and pests of crop plants</p> <p><b>CO5-</b> Summarized the advantages and disadvantages of current control practices based on chemical ecology, genetics of plant resistance and breeding including transgenic approaches</p> <p><b>CO6-</b> Combine theoretical and practical knowledge of plant disease and pest management</p>
<b>MBOC 401</b>	<b>Conservation Biology</b>	<p><b>CO1-</b> Remember the Knowledge of basic concepts and history of conservation biology.</p> <p><b>CO2-</b> Understand and Learn origin and evolution of organism; genetic plasticity and the invasion of unoccupied ecological niches and conservation strategies of biological resources.</p> <p><b>CO3-</b> Apply and Correlate global and regional patterns of biodiversity. Explain PAN and its conservation.</p> <p><b>CO4-</b> Explain about the Global environmental problems: Global warming, ozone depletion, desertification.</p> <p><b>CO5-</b> Summarized the concept of species extinction, endangered species, Red and Green Data Books.</p> <p><b>CO6-</b> Develop the Plan of Environmental Impact Assessment (EIA).</p>
<b>MBOC 402</b>	<b>Biotechnology and Genetic Engineering of Plants and Microbes</b>	<p><b>CO1-</b> Remember the basic concepts, principles and scope of Biotechnology.</p> <p><b>CO2-</b> Understand the general introduction, history, scope and concept of plant cell and tissue culture with Recombinant DNA technology.</p> <p><b>CO3-</b> Explain the fundamental aspects of organogenesis and adventitious embryogenesis</p> <p><b>CO4-</b> Analyze the concepts, key features and limitations of somatic hybridization technique and Recombinant DNA techniques.</p> <p><b>CO5-</b> Summarized the applications of Recombinant DNA technology and plant tissue culture.</p> <p><b>CO6-</b> Create the fundamentals of Biotechnology with reference to microbes and plants.</p>
<b>MBOL 403</b>	<b>Laboratory Course-I</b>	<p><b>CO1-</b> Recite, Learn and identify pattern of regional biodiversity and tissue culture.</p> <p><b>CO2-</b> Understand and survey of biological resources</p> <p><b>CO3-</b> Explain and Collect and enhance information regarding visiting national parks, sanctuaries and biosphere reserves of Uttarakhand</p> <p><b>CO4-</b> Analyze the protoplast fusion employing PEG and DNA sequencing by Sanger's dideoxy method</p> <p><b>CO5-</b> Evaluation of the biotechnology process and conservation biology problems.</p> <p><b>CO6-</b> Develop the scientific approach toward nature for human welfare.</p>



<b>MBOE 404</b>	<b>Dissertation</b>	<b>CO1-</b> Recite the subject knowledge. <b>CO2-</b> Discuss and understand the scientific temperament. <b>CO3-</b> Apply the fundamentals of research methodology. <b>CO4-</b> Focus on the skills for the writing of thesis and scientific papers. <b>CO5-</b> Justify the knowledge of course work. <b>CO6-</b> Create awareness and interest towards research.
<b>MBOE 405</b>	<b>Environment Management with reference to Western Himalaya</b>	<b>CO1-</b> Remember and recall the environmental, social and economic framework in which environmental management decisions are made <b>CO2-</b> Understand and Anticipate and control environmental issues <b>CO3-</b> Apply Recognize and control factors in the workplace and the environment that cause health and environmental hazards and utilize quantitative knowledge and skills and modern tools and technologies to analyze, plan, and implement environmental management systems <b>CO4-</b> Analyze, Prepare, review, and update environmental monitoring and assessment Reports and Monitor progress of environmental improvement programs <b>CO5-</b> Conclude and develop management systems and formulate solutions that are technically sound, economically feasible, and socially acceptable. Assess the potential environmental impact of development projects and design mitigation measures <b>CO6-</b> Adapt and develop the environmental performance to internal and external clients and regulatory bodies and find professional level employment or pursue higher studies and pursue research for contributing to the betterment of humanity and in shaping a sustainable society
<b>MBOE 406</b>	<b>Seed Pathology</b>	<b>CO1-</b> Remember the basics of seed pathology. <b>CO2-</b> Understand about the kinds of seed borne pathogens. <b>CO3-</b> Explain the Infer the types of damage caused by the seed borne fungi to seeds and crops. <b>CO4-</b> Apply and Learn the nature of seed infection, longevity of seed borne pathogens, Epiphytology of seed borne diseases, monocyclic and polycyclic diseases. <b>CO5-</b> Summarized the methodology of detection of seed borne pathogens. <b>CO6-</b> Develop the knowledge of Seed Pathology.
<b>MBOL 407</b>	<b>Laboratory Course-II</b>	<b>CO1-</b> Recite the understanding of seed soaking method for the detection of seed borne pathogens. <b>CO2-</b> Understand and Learn identification of key stone species <b>CO3-</b> Apply and Enumerate phytoplankton and benthos from aquatic bodies <b>CO4-</b> Illustrate the agar plate method for the detection of bacteria and fungi

		<p><b>CO5-</b> Evaluate, estimate and analyse BOD, COD and DO of water.</p> <p><b>CO6-</b> Create an idea to develop problems solving approach.</p>
<b>MBOS 408</b>	<b>Analytical Techniques in Plant Sciences</b>	<p><b>CO1-</b> Remember the Imaging and related techniques, Cell fractionation, Radioisotopes, Spectrophotometry, Chromatography and Biostatistics</p> <p><b>CO2-</b> Understand to use electrophoresis and Blotting techniques for DNA, RNA, and, protein characterization, paper chromatography for nitrogenous bases separation by, layer chromatography for sugar separation, prepare slides for microscopic studies</p> <p><b>CO3-</b> Apply and Understand principles and technicality of Mass spectroscopy, X-ray diffraction, X-ray crystallography and various types of electrophoresis techniques.</p> <p><b>CO4-</b> Analyze the applications of paper chromatography, column chromatography, TLC, GLC, HPLC</p> <p><b>CO5-</b> Summarized the principles of different types of microscopy; types of centrifugation, spectrophotometer, chromatography; techniques of characterization of proteins and nucleic acids; use of radioisotopes in biological research; preliminary biostatistics</p> <p><b>CO6-</b> Develop the knowledge about Analytical Techniques in Plant Sciences.</p>
<b>MBOS 409</b>	<b>Nursery and Gardening</b>	<p><b>CO1-</b> Describe the objectives and scope of Nursery, Gardening and cultivation of various vegetables.</p> <p><b>CO2-</b> Explain about the structure and types of seed, seed dormancy, Seed production technology, seed testing and certification etc.</p> <p><b>CO3-</b> Illustrate the methods of Nursery, Gardening and vegetative propagation.</p> <p><b>CO4-</b> Analyze the definition, objectives and scope of different types of Nursery &amp; gardening</p> <p><b>CO5-</b> Summarized the knowledge sowing and raising of seeds and seedlings, transplanting and cultivation of seedlings and marketing procedures of vegetables.</p> <p><b>CO6-</b> Design the idea of Nursery and Gardening.</p>

## MASTER OF SCIENCE (GEOLOGY)

### Program Outcome (PO)

<b>PO 1</b>	To provide an in-depth knowledge and skills in the field of Earth sciences to the students and research methods through laboratory, field and online modes of learning.
<b>PO2</b>	Recognize the need for sustainable use of earth resources, and value the environmental, indigenous and other community perspective on geological activities.
<b>PO3</b>	To understand and apply geological knowledge student will be capable appreciating the existence and exploration of natural resource system.
<b>PO4</b>	Apply the knowledge of geology makes the students fully competent to undertake any job in the field of Geology.
<b>PO5</b>	Work effectively and professionally along with multidisciplinary teams and be able to manage and analyse ethical issues.
<b>PO6</b>	To develop an interest for the student to take up higher studies in field of earth sciences.
<b>PO7</b>	Ability to recognize, evaluates, interpret, and understand issues and opportunities at the frontiers of geological domain.
<b>PO8</b>	To understand and communicate geological information concisely and accurately using written, visual, and verbal means appropriate to the situation.
<b>PO9</b>	Students will be fully aware of the earth environment and responsible for the management of environment
<b>PO10</b>	The students will be capable of appreciating the existence and exploration of natural resource system.
<b>PO11</b>	Makes the students fully competent to undertake any job in the field of Geology.
<b>PO12</b>	Gains complete knowledge about all fundamentals of Geoscience branches.

## M.Sc. GEOLOGY

### Program Specific Outcome (PSO)

<b>PSO1</b>	To gain the knowledge of essential properties of earth components, including its core, mantle, asthenosphere, lithosphere, cryosphere, hydrosphere, atmosphere and biosphere.
<b>PSO2</b>	To understand the geomorphic process, structural & tectonics problems, petrological process, mineralogical and their properties & crystallographic orientation, chronological arrangement of rocks, economic mineral deposits, geophysical & mining methods, ore deposits and their occurrences, geohydrological problems and environmental issues etc.
<b>PSO3</b>	Acquiring geologic data in the field, laboratory, satellites and big data from data banks, Analysing and interpreting the acquired data through application of scientific method.
<b>PSO4</b>	Apply knowledge and techniques from allied fields, including chemistry, physics, biology, mathematics, and computing, to solve geological problems.
<b>PSO5</b>	Students take-up a geologic problem and utilize theoretical, analytical or experimental approach to solve the problem through their project work.

### Course Outcomes (COs)

Course Code	Course Name	Outcome
<b>MGLC101</b>	<b>General Geology and Geomorphology</b>	<b>CO1-</b> To gain the knowledge about the Earth's Energy Balance, Hydrological cycle, Topography and bathymetry. Learning about the sedimentary flux: origin, transport and deposition.
		<b>CO2-</b> To understand about the geomorphic and sedimentological processes related to fluvial, coastal, aeolian, and glacial regimes.
		<b>CO3-</b> To apply the knowledge about the environmental changes and its impact on surface processes, landforms, weathering, soil and classification
		<b>CO4-</b> To classify the stream orders and drainage system
		<b>CO5-</b> Differentiate between geosyncline and mountain building process their evolution, volcanoes, epeiorogeny etc.
		<b>CO6-</b> Write about the slope morphometry, quaternary geomorphology, geomorphology and geomorphic hazards of Uttarakhand.
<b>MGLC102</b>	<b>Structural Geology</b>	<b>CO1-</b> To gain the knowledge and accurate geometric description of the structures observed in natural deformed rocks.
		<b>CO2-</b> To understand the basic scope of structural geology, properties of rocks and factors affecting the behaviour of rocks.
		<b>CO3-</b> To classify the fold, fault, joints and unconformities and other structures
		<b>CO4-</b> To analyse kinematics of deformation, theory of stress, strain and stress ellipsoids
		<b>CO5-</b> To estimate Strain marker and Measurement of strain in deformed rocks the stresses when rocks goes under the deformation by using Mohr's circle
		<b>CO6-</b> Write about the Basic idea about petrofabrics and use of Universal stage, cleavage, lineation
<b>MGLC103</b>	<b>Mineralogy</b>	<b>CO1-</b> Learn and Gain knowledge of chemical bonding, types of atom, and properties of minerals, different silicate structure, uniaxial and biaxial crystal.
		<b>CO2-</b> Understand Properties of uniaxial and biaxial crystal
		<b>CO3-</b> Explain structure of silicates.
		<b>CO4-</b> Classify Silicate, and Explain the different properties of minerals.
		<b>CO5-</b> Distinguish among different properties of minerals.
		<b>CO6-</b> Compose structure of various silicates.
<b>MGLC104</b>	<b>General and Invertebrate Paleontology</b>	<b>CO1-</b> Gain the basic knowledge of fossils, Identification of fossils, origin and evolution of life, dispersion and extinction.
		<b>CO2-</b> Classify types of fossils, morphology and geological distribution of various groups.
		<b>CO3-</b> Techniques of collection of fossils, explain the mode of preservation, Explain the origin and evolution of life.
		<b>CO4-</b> Compare the evolutionary relationships among a set of

		<p>organisms, types of fossils.</p> <p><b>CO5-</b> Summarize the modes of life of fossil organisms, Biostratigraphy, Paleocology and Uses.</p> <p><b>CO6-</b> To develop the fundamentals concept of Zoogeographic provenance, dispersal and extinction of organism, Early Pre cambrian life, organo-sedimentary structures</p>
<b>MGLL105</b>	<b>Lab Course based on C101&amp;C102</b>	<p><b>CO1-</b> To gain the knowledge of different drainage patterns and stream numbers orders</p> <p><b>CO2-</b> To understand and preparation and interpretation of geological maps and sections</p> <p><b>CO3-</b> Structural problems and Altimetric analysis, hypsometric analysis, exercises related to measurements of run off dynamics, sediment and solute dynamics. Morphometry of drainage basins, analysis of orientation structures.</p> <p><b>CO4-</b> To analysis of geomorphological features from various morphogenetic regions of India</p> <p><b>CO5-</b> Estimate and measurements of run off dynamics, sediment and solute dynamics.</p> <p><b>CO6-</b> Preparation of longitudinal and cross valley profiles and preparation of geomorphological maps on different scales (1:25,000, 50,000 &amp; 1:50,000).</p>
<b>MGLL106</b>	<b>Lab Course based on C103&amp;C104</b>	<p><b>CO1-</b> To gain the knowledge and study of minerals in hand specimen Microscopic study of rock forming minerals.</p> <p><b>CO2-</b> To understand the mineral properties, nature and evolution under the microscope.</p> <p><b>CO3-</b> To classify the important invertebrate fossil belonging to brachiopoda, bivalve, gastropoda, cephalopoda, trilobita and echinods.</p> <p><b>CO4-</b> To analyses the morphological characteristics of invertebrate fossils</p> <p><b>CO5-</b> To evolution mineral properties, mineral nature and characteristic under the microscope</p> <p><b>CO6-</b> Draw the silicate structures</p>
<b>MGLC201</b>	<b>Crystallography</b>	<p><b>CO1-</b> Gain knowledge of space group, space lattice, defects, symmetry elements, Bragg's Law, goniometer, normal class of crystal system, projection, imperfection, twinning</p> <p><b>CO2-</b> Explain the concepts of normal class of crystal system, lattice defects, point, and imperfection.</p> <p><b>CO3-</b> Apply the basic concept of twinning and its application and methods of X-ray on the crystal system.</p> <p><b>CO4-</b> Evaluate Bragg's law and explain different type of crystal projection.</p> <p><b>CO5-</b> To estimate the packing density of Braves lattice and describe different diffraction methods and symmetry elements of normal class.</p> <p><b>CO6-</b> Express the views on goniometer, symmetrical elements of different crystal system and imperfection of crystal.</p>
<b>MGLC202</b>	<b>Geotectonics</b>	<p><b>CO1-</b> To gain the knowledge of the dynamic nature of the Earth processes,</p> <p><b>CO2-</b> To understand about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics.</p> <p><b>CO3-</b> To classify the present geophysical and geological evidence for the processes operating in modern tectonic systems</p>



		<p><b>CO4-</b> Distinguished between the major continental features and oceanic features and other tectonic features</p> <p><b>CO5-</b> Explain about the seismicity and their global distribution on earths and geodynamics of Indian plate</p> <p><b>CO6-</b> Write about the Palaeo magnetism and paleo magnetic maps , polar wandering curve and sea floor spreading and evolution of Himalayas</p>
<b>MGLC203</b>	Micropaleontology, Vertebrate Palaeontology and Paleobotany	<p><b>CO1-</b> Gain knowledge of the main systematic groups of vertebrate, microfossils, its distribution and Paleobotany and Palynology.</p> <p><b>CO2-</b> Distinguish various microfossils group on the basis of morphology, pollen and spores.</p> <p><b>CO3-</b> Collection and preparation of microfossils, and Explain the morphology of Gondwana flora.</p> <p><b>CO4-</b> To analyse descriptive data of microfossils and associated sedimentary materials using adequate concepts, methodologies.</p> <p><b>CO5-</b> Correlated the concept of pollen and spores, and morphology of various group.</p> <p><b>CO6-</b> To construct the phylogeny of man, horse and elephant and pollen and spores.</p>
<b>MGLC204</b>	<b>Stratigraphy</b>	<p><b>CO1-</b> Learn and Gain Knowledge of fundamentals of stratigraphic principles and various methods of stratigraphic analysis will be provided.</p> <p><b>CO2-</b> To understand the concept of Geological Time Scale and Facies concept,</p> <p><b>CO3-</b> Explain about the various age group rocks occurring in India and the boundaries separating them, Geological Time events of The Paleozoic, Gondwana, Triassic, Jurassic and Cretaceous and the Tertiary Group</p> <p><b>CO4-</b> The stratigraphic classification from craton, mobile belt, Proterozoic to Phanerozoic succession from India is the goal of this course.</p> <p><b>CO5-</b> Compare the stratigraphic boundaries eg: PC, PT, KT with Indian example</p> <p><b>CO6-</b> Write the detailed significance of the Siwalik, Pleistocene, Holocene, Himalayas, and Eocene systems.</p>
<b>MGLC205</b>	<b>Geological Field Training Tour</b>	<p><b>CO1-</b> The course is intended to expose students to any economic deposit, familiarize them about host rock and economic mineral relationship, variable geometry of ore bodies.</p> <p><b>CO2-</b> To understand the planning of exploration and exploitation, Open and/or underground mine section.</p> <p><b>CO3-</b> To apply the knowledge of geology to identify the structures and microstructures in the field</p> <p><b>CO4-</b> To analyse the fundamentals work on the field.</p> <p><b>CO5-</b> To estimate the collected data from the field.</p> <p><b>CO6-</b> To develop skills for the writing of the tour report.</p>
<b>MGLL206</b>	<b>Lab Course based on C201 to C204</b>	<p><b>CO1-</b> To gain the knowledge of Crystal model and projection</p> <p><b>CO2-</b> To understand and study of important Microfossils, Study of Vertebrate fossils and Gondwana Flora</p> <p><b>CO3-</b> To classify paleo-geographic maps of Precambrian and Phanerozoic</p> <p><b>CO4-</b> Chronological study of important rocks</p> <p><b>CO5-</b> the Stereographic presentation of structural data ,</p> <p><b>CO6-</b> To develop the Crystal model and projection</p>

<b>MGLC301</b>	<b>Igneous Petrology and Geochemistry</b>	<p><b>CO1-</b> Learn and Gain Knowledge of characterize, identify and name different types of rocks in the field and in hand-specimens, and rock-thin sections, and finally they will propose the rock-forming processes.</p> <p><b>CO2-</b> Understand the formation, texture, structure of Igneous rocks.</p> <p><b>CO3-</b> Explain the use of Petrography of Igneous rocks</p> <p><b>CO4-</b> Classify the Igneous rock, Crystallization of uni-component and bi-component (mix-crystals); Bowen's reaction principle</p> <p><b>CO5-</b> Distinguish between different types of igneous rocks and application of Gibbs phase rule in Uni component, Bi component and Tri component system</p> <p><b>CO6-</b> Write the process of magmatism, petrography of igneous rock and geochemistry of Earth's</p>
<b>MGLC302</b>	<b>Engineering Geology</b>	<p><b>CO1-</b> To gain the knowledge about the selection of most suitable sites for any civil structure, properties of rock, dam, tunnel, road, landslide and bridge.</p> <p><b>CO2-</b> To understand the selection of suitable construction materials for any such project work like -Dam, Tunnel, bridge.</p> <p><b>CO3-</b> Explain the detail of landslide, Engineering properties of rocks</p> <p><b>CO4-</b> To analyses lithology and structures of the area to leading the way for infrastructural development for the country.</p> <p><b>CO5-</b> To evaluate the geologic hazards and others adverse conditions like seismic hazards and landslide etc.</p> <p><b>CO6-</b> To develop and create the detailed design of engineering works.</p>
<b>MGLE304</b>	<b>Sedimentary and Metamorphic Petrology</b>	<p><b>CO1-</b> Learn and Gain Knowledge of characterize, identify and name different types of rocks in the field and in hand-specimens, and rock-thin sections, and finally they will propose the rock-forming processes.</p> <p><b>CO2-</b> Understand the formation, texture, structure of Sedimentary and Metamorphic rock.</p> <p><b>CO3-</b> Explain the use of Petrography of Sedimentary and Metamorphic rock.</p> <p><b>CO4-</b> Classify the sedimentary and Metamorphic rocks</p> <p><b>CO5-</b> Distinguish between different types of sedimentary and metamorphic rocks.</p> <p><b>CO6-</b> Write the process of sedimentation and metamorphism, agents of metamorphism, petrography of metamorphic rock.</p>
<b>MGLE305</b>	<b>Mineral Exploration and Mining Geology</b>	<p><b>CO1-</b> To understand the knowledge of selected ore deposit types, including genesis and exploration requirements.</p> <p><b>CO2-</b> To understand the prospecting methods and sampling methods and assaying</p> <p><b>CO3-</b> To classify the exploration methods and Geochemical &amp; Geo-botanical exploration methods</p> <p><b>CO4-</b> To differentiate the geophysical methods eg:- gravity, magnetic and seismic methods etc.</p> <p><b>CO5-</b> To distinguished between the surface mining methods and underground mining methods</p> <p><b>CO6-</b> Write about the mining processes and mining hazards and their impact</p>

<b>MGLL303</b>	<b>Lab Course based on C301&amp;C302</b>	<p><b>CO1-</b> To gain the knowledge of Megascopic study of different types of igneous rocks. Microscopic study of important igneous rocks.</p> <p><b>CO2-</b> To understand the properties of common rocks with reference to their utility in engineering projects.</p> <p><b>CO3-</b> To classify and study of maps and models of important engineering structures, dam sites and tunnels.</p> <p><b>CO4-</b> To analyse the survey of a plot using Chain, Prismatic compass, Plane table, GPS data collection and plotting.</p> <p><b>CO5-</b> Interpretation of geological maps for landslides problems.</p> <p><b>CO6-</b> Plotting of modal data is IUGS diagram</p>
<b>MGLL306</b>	<b>Lab Course based on E304&amp;E305</b>	<p><b>CO1-</b> To gain the knowledge and preparation of mineral maps of India. Graphical representation of production, export and import of important minerals.</p> <p><b>CO2-</b> To classify and understand the nature of sedimentary and metamorphic rocks in hand specimen.</p> <p><b>CO3-</b> To analyze the sedimentary and metamorphic rocks in thin sections with emphasis on texture, structure and mineral composition.</p> <p><b>CO4-</b> To analyses and interpretation of remote sensing data for mineral exploration.</p> <p><b>CO5-</b> To estimate the average grade and ore reserves.</p> <p><b>CO6-</b> To develop and graphic construction of ACF, AKF and AFM diagrams.</p>
<b>MGLS307</b>	<b>Petroleum Geology</b>	<p><b>CO1-</b> To gain the knowledge of different chemical constituents of oil and gas, Oil field brines, their classification, importance and alteration</p> <p><b>CO2-</b> To understand the knowledge about geophysical and geological methods for oil and gas exploration.</p> <p><b>CO3-</b> To classify and identify different petroliferous basins of India and their associated lithology, Stratigraphy, structure.</p> <p><b>CO4-</b> To differentiate the structures like folds, faults, joints, unconformity, salt domes and Oil and gas fields associated with buried hills</p> <p><b>CO5-</b> To estimate the fixed carbon ration in the hydrocarbon and the calorific value</p> <p><b>CO6-</b> Write about the distribution of important petroliferous basins of India and world</p>
<b>MGLS308</b>	<b>Environment Geology</b>	<p><b>CO1-</b> To gain the knowledge and recognition of natural hazards and mitigation of their human impacts To understand and learn the concepts of environmental geology,</p> <p><b>CO2-</b> To understand and learn the managing geological resources,</p> <p><b>CO3-</b> To understand and learn the appropriate use of the geological environment for waste disposal</p> <p><b>CO4-</b> To classify the natural hazards and mitigation, their human impacts.</p> <p><b>CO5-</b> Write about the water and pollution waste managements</p> <p><b>CO6-</b> Develop an urban concept: Urban Environments; Urban planning and geology</p>
<b>MGLC401</b>	<b>: Geohydrology</b>	<p><b>CO1-</b> <b>Gain knowledge, comprehend the hydrologic cycle</b> water table fluctuations, Aquifers, quality of water, method of rain water harvesting and Geological and geophysical methods</p> <p><b>CO2-</b> <b>Summarize the</b> problems of arsenic and fluorides and Explain geophysical methods of groundwater.</p>

		<p><b>CO3-</b> Solve the equation of Darcys law and its application, and illustrate the rain water harvesting, groundwater conditions of India.</p> <p><b>CO4-</b> Analyse the hydrological properties of rocks, Theory of groundwater flow, groundwater contaminations.</p> <p><b>CO5-</b> Distinguish among wells and aquifers, groundwater legislation and permeability.</p> <p><b>CO6-</b> Compose hydrological cycle, and write the concept of groundwater quality, groundwater provinces of India.</p>
<b>MGLC402</b>	<b>Ore Genesis and Indian Mineral Deposits</b>	<p><b>CO1-</b> To gain the knowledge and identify the ore deposits in wide variety of geological environments and how they formed and how they react with surrounding and how the natural barrier controls them in suitable reservoir.</p> <p><b>CO2-</b> To understand the wide variety of metalliferous ore forming processes.</p> <p><b>CO3-</b> To classify the distribution of metallic ore and non-metallic ores</p> <p><b>CO4-</b> To compare the metallogenic epochs and provinces of Indian subcontinent, Para genesis, zoning</p> <p><b>CO5-</b> Differentiate between strategic, critical and essential minerals and mineral resources of Uttarakhand.</p> <p><b>CO6-</b> Write about the concept of mineral policy, production, future aspect and mineral deposits of Indian oceans</p>
<b>MGLL403</b>	<b>Lab Course based on C401&amp;C402</b>	<p><b>CO1-</b> To gain the knowledge of economic minerals in hand specimen. To analyse the delineation of hydrological boundaries on watertable, contour maps and estimation of permeability.</p> <p><b>CO2-</b> Study of geological maps and sections of important oil fields of India and world.</p> <p><b>CO3-</b> To understand and preparation of mineral maps of India. Graphical representation of production, export and import of important minerals.</p> <p><b>CO4-</b> To analysis of hydrographs and estimation of infiltration capacity. Chemical analysis of water in evaluation of aquifer parameters. Step draw down tests, electric resistivity sounding for delineation of fresh and saline aquifers.</p> <p><b>CO5-</b> Exercise on ground water exploration using remote sensing techniques.</p> <p><b>CO6-</b> Calculation of oil reserves Calculation of grade and ore reserves. Interpretation of remote sensing data for mineral exploration</p>
<b>MGLE404</b>	<b>Geological Field Training Tour</b>	<p><b>CO1-</b> The course is intended to expose students to any economic deposit, familiarize them about host rock and economic mineral relationship, variable geometry of ore bodies.</p> <p><b>CO2-</b> To understand the planning of exploration and exploitation, Open and/or underground mine section.</p> <p><b>CO3-</b> To apply the knowledge of geology to identify the structures and microstructures in the field</p> <p><b>CO4-</b> To analyse the fundamentals work on the field.</p> <p><b>CO5-</b> To estimate the collected data from the field.</p> <p><b>CO6-</b> To develop skills for the writing of the tour report.</p>

<b>MGLE405</b>	<b>Project/Dissertation</b>	<b>CO1-</b> To gain Knowledge and develop awareness and interest towards research. <b>CO2-</b> To understand the development of scientific temperament. <b>CO3-</b> Apply Principles of research design to solve the problems in the field of research. <b>CO4-</b> Analyse critically various research problem <b>CO5-</b> Evaluate the links between theory and methods within their field of study. <b>CO6-</b> Create various research solutions.
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## MASTER OF SCIENCE

### Program Outcome (PO)

PO 1	Scientific exploration: Capability of comprehending basic scientific principles, and theories to propose solutions.
PO2	Conduct experimentation: Use explorative aptitude and analytical methods for design of experiments, analysis and interpretation of data and synthesis of information to provide effective conclusions.
PO3	Ethics: Apply ethical principles and commit to professional ethics and responsibilities for societal benefits.
PO4	Communication: Communicate effectively scientific findings, and to be able to assimilate, write and present effective reports to give and receive clear instruction.
PO5	Societal Impact: Acquire and apply advanced knowledge of concepts and participate in sustainable development.
PO6	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO7	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of upcoming scientific change.
PO8	Research Problem Solving: Ability to assimilate, evaluate and present research results objectively.
PO9	Master of Science offers theoretical as well as practical knowledge about different area of chemistry subject.
PO10	The qualities of a science – observation, precision, analytical mind, logical thinking, clarity of thought and expression, systematic approach, qualitative and quantitative decision making are enlarged.
PO11	The program also empowers the post graduates to appear for various competitive examinations or choose the PhD programme of their choice.
PO12	Think critically, follow innovations and developments in science and technology.

## M.Sc. CHEMISTRY

### Program Specific Outcome (PSO)

PSO 1	Understand the advanced concepts of organic and inorganic synthesis, Molecular and Interpretative spectroscopy and quantum chemistry.
PSO2	Perform procedures as per laboratory standards in the areas of analytical chemistry, organic and inorganic synthesis and structure interpretation.
PSO3	Exhibit the ability of comprehending the problem and building research oriented solutions.
PSO4	Understand and apply applications of organic and inorganic synthesis in pharmaceuticals.

**Course Outcome (CO)**

<b>Course Code</b>	<b>Course Name</b>	<b>Outcome</b>
<b>MCHC-101</b>	<b>Inorganic Chemistry I</b>	<b>CO1-</b> Learn and gain knowledge of main group compounds and coordination chemistry <b>CO2-</b> Describe theories of coordination compounds and explain metal ligand equilibria and solutions. <b>CO3-</b> Explain reaction mechanisms of transition metal complexes. <b>CO4-</b> Illustrate CFT, MOT, VSEPR theory and chelate effect. <b>CO5-</b> Assess different types of reaction mechanism. <b>CO6-</b> Propose the structure of various inorganic compounds based on VSEPR model and hybridization.
<b>MCHC-102</b>	<b>Organic Chemistry I</b>	<b>CO1-</b> Gain Knowledge about different type reaction mechanism, aromatic compounds, and substitution reactions. <b>CO2-</b> Understand the concept of different type reaction mechanism, aromatic compounds, and substitution reactions. <b>CO3-</b> Explain the concept of reaction mechanism, aromatic compounds, and substitution reactions. <b>CO4-</b> Illustrate reaction mechanism, aromaticity, and substitution reactions. <b>CO5-</b> Compare different type stereochemical and substitution reactions. <b>CO6-</b> Write about the different type reaction mechanism, aromatic compounds, and substitution reactions.
<b>MCHC-103</b>	<b>Physical Chemistry I</b>	<b>CO1-</b> Describe basic principles of Quantum Mechanics, Classical Thermodynamics and Surface Chemistry. <b>CO2-</b> Understand molecular orbital theory to explain bonding and molecular structure on the basis of quantum mechanics, Discuss different concept based on surface adsorption and curved surface. <b>CO3-</b> Explain laws of Thermodynamics for the determination of different quantities, apply appropriate approximation techniques for the analysis of multi electron molecules. <b>CO4-</b> Analyze the classical thermodynamics and to explore the ideas of non-ideal systems and phase diagrams, <b>CO5-</b> Estimate the Quantum mechanics result, approximate methods, chemical bonding in di atomics <b>CO6-</b> Solve the problems based on Quantum chemistry, Surface phenomena and thermodynamics
<b>MCHC-104</b>	<b>Spectroscopy and Group Theory</b>	<b>CO1-</b> Remember the basics of spectroscopy and group theory. <b>CO2-</b> Understand the interaction of matter with EMR, and different spectroscopic techniques. <b>CO3-</b> Explain about theory, instrument, applications of spectroscopy. <b>CO4-</b> Explain EMR and spectroscopic techniques and group theory. <b>CO5-</b> Assess and summarize the structures of organic compounds by using spectroscopic techniques. <b>CO6-</b> Generalize the concept related to spectroscopy and group theory.

<b>MCHL 105</b>	<b>Laboratory Course I</b>	<b>CO1-</b> Remember the basics of chemistry practicals and lab rules <b>CO2-</b> Understand the basics of chromatography, qualitative semimicro analysis and chemical kinetics. <b>CO3-</b> Apply Paper and Thin Layer Chromatography to separate and identify given mixtures <b>CO4-</b> Analyze and interpret the results of different experiments <b>CO5-</b> Evaluate the experimental data and errors. <b>CO6-</b> Determine the different parameters related to chemical kinetics.
<b>MCHL 106</b>	<b>Laboratory Course II</b>	<b>CO1-</b> Remember the basics of chemistry practicals and lab rules. <b>CO2-</b> Understand the basics of organic synthesis and physical chemistry. <b>CO3-</b> Set experiment for organic synthesis and chromatography. <b>CO4-</b> Analyze the RF values of cationic and anionic mixtures by chromatography. <b>CO5-</b> Evaluate the experimental data and errors. <b>CO6-</b> Determine the different parameters related to physical chemistry.
<b>MCHC 201</b>	<b>Inorganic Chemistry II</b>	<b>CO1-</b> Learn and gain knowledge of electronic spectra, magnetic properties of transition metal complexes, metal $\pi$ complexes, metal clusters and silicates. <b>CO2-</b> Understand electronic spectra, magnetic properties metal $\pi$ complexes, metal clusters and silicates. <b>CO3-</b> Understand the classification of silicates and charge transfer spectra. <b>CO4-</b> Illustrate preparation, properties and uses of metal $\pi$ complexes, organometallic compounds and metal clusters. <b>CO5-</b> Compare various types of boranes and carboranes. <b>CO6-</b> Express the applications of silicates in technology and solve problems related to R-S coupling.
<b>MCHC 202</b>	<b>Organic Chemistry II</b>	<b>CO1-</b> Get knowledge about the pericyclic, substitution, addition, elimination and free radicals reactions. <b>CO2-</b> Understand about the pericyclic, substitution, addition, elimination and free radicals reactions. <b>CO3-</b> Explain various pericyclic, substitution, addition, elimination and free radicals reactions. <b>CO4-</b> Illustrate different of pericyclic, substitution, addition, elimination and free radicals reactions. <b>CO5-</b> Compare the mechanism of pericyclic, substitution, addition, elimination and free radicals reactions. <b>CO6-</b> Write about different type pericyclic, substitution, addition, elimination and free radicals reactions.
<b>MCHC 203</b>	<b>Physical Chemistry II</b>	<b>CO1-</b> Observe basic principles of Chemical Dynamics, Statistical Thermodynamics, Non-Equilibrium Thermodynamics, and Electrochemistry. <b>CO2-</b> Interpret the basic elements and laws of statistical thermodynamics, estimate thermodynamics criteria for non-equilibrium states. <b>CO3-</b> Illustrate the knowledge of chemical dynamics in deriving kinetics of various reactions, determine the electrochemistry of various solution and explain its theory. <b>CO4-</b> Analyze various regions of the electromagnetic spectrum which can be used to measure different aspects of

		<p>molecular structure.</p> <p><b>CO5-</b> Consider the theory and principles of solution in electrochemistry and its various applications.</p> <p><b>CO6-</b> Solve the problems based on Chemical Dynamics, Statistical, Non-Equilibrium Thermodynamics, and Electrochemistry.</p>
<b>MCHC 204</b>	<b>Spectroscopy and separation methods</b>	<p><b>CO1-</b> Remember the basics of spectroscopy, chromatography and radio analytical techniques.</p> <p><b>CO2-</b> Understand the theory, principle and instrumentation of NMR, Mass and molecular electronic spectroscopy.</p> <p><b>CO3-</b> Explain principle, instrument and applications of chromatographic and radioanalytical techniques.</p> <p><b>CO4-</b> Explain different terms used in spectroscopy and chromatography and radioanalytical techniques.</p> <p><b>CO5-</b> Illustrate the theory and uses of spectroscopy and chromatography.</p> <p><b>CO6-</b> Solve exercises related to spectroscopy, chromatography and radioanalytical techniques.</p>
<b>MCHL 205</b>	<b>Laboratory Course I</b>	<p><b>CO1-</b> Remember the basics of chemistry practicals and lab rules.</p> <p><b>CO2-</b> Understand basics of inorganic, organic and physical chemistry.</p> <p><b>CO3-</b> Apply their knowledge in synthesis of various organic compounds.</p> <p><b>CO4-</b> Analyze mixture of two metal ions using volumetric and gravimetric analysis.</p> <p><b>CO5-</b> Evaluate the experimental data.</p> <p><b>CO6-</b> Infer the spectroscopic results.</p>
<b>MCHL 206</b>	<b>Laboratory Course II</b>	<p><b>CO1-</b> Remember the basics of chemistry practicals and lab rules.</p> <p><b>CO2-</b> Understand basics of inorganic, organic and physical chemistry.</p> <p><b>CO3-</b> Prepare inorganic compounds.</p> <p><b>CO4-</b> Estimate hydroxyl groups, BOD, COD, iodine and saponification value etc.</p> <p><b>CO5-</b> Evaluate the experimental data.</p> <p><b>CO6-</b> Determine different parameters of physical chemistry by PH meter.</p>
<b>MCHC 301</b>	<b>ORGANIC SYNTHESIS AND PHOTOCHEMISTRY</b>	<p><b>CO1-</b> Get Knowledge about the various photochemical reactions and organic synthesis.</p> <p><b>CO2-</b> Understand about the various photochemical reactions and organic synthesis.</p> <p><b>CO3-</b> Explain various photochemical reactions and organic synthesis.</p> <p><b>CO4-</b> Illustrate various photochemical reactions and organic synthesis.</p> <p><b>CO5-</b> Compare the mechanism of various photochemical reactions and organic synthesis.</p> <p><b>CO6-</b> Write about the various synthetic routes of photochemical reactions and organic synthesis.</p>
<b>MCHC 302</b>	<b>Heterocyclic Chemistry</b>	<p><b>CO1-</b> Get knowledge about basics of heterocyclic compounds.</p> <p><b>CO2-</b> Understand nomenclature, general behaviour, synthesis and properties of heterocyclic compounds.</p> <p><b>CO3-</b> Explain synthesis, properties and uses of heterocyclic compounds.</p> <p><b>CO4-</b> Explain aromatic, nonaromatic features, synthesis and properties of different heterocyclic compounds.</p>

		<p><b>CO5-</b> Predict the reactivity, isomerism , conformers etc of heterocyclic compounds.</p> <p><b>CO6-</b> Write the synthesis and applications of six and seven membered heterocyclic compounds</p>
<b>MCHL 303</b>	<b>Laboratory Course I</b>	<p><b>CO1-</b> Describe the practical concepts underlying the purification, separation and analysis of organic mixture of a compound</p> <p><b>CO2-</b> Distinguish a range of practical techniques used in science such as the analysis of substances, the separation of substances and the use of instruments/ glassware's.</p> <p><b>CO3-</b> Develop the ability of performing accurate quantitative measurements with an understanding of the theory and use of contemporary instrumentation.</p> <p><b>CO4-</b> Analyse the practical concept qualitatively and quantitatively.</p> <p><b>CO5-</b> Test the purity of separated compounds.</p> <p><b>CO6-</b> Develop Preparation of derivatives and spectral analysis.</p>
<b>MCHL 304</b>	<b>Laboratory Course II</b>	<p><b>CO1-</b> Examine organic compounds and to identify various functional group transformations.</p> <p><b>CO2-</b> Identify the organic compounds in the ternary mixture using separation techniques and confirmatory tests.</p> <p><b>CO3-</b> Illustrate various synthetic methodologies involved in organic synthesis.</p> <p><b>CO4-</b> Analyze different synthetic methodologies involved in organic chemistry.</p> <p><b>CO5-</b> Measure their experimental skills for synthesis of various organic compounds.</p> <p><b>CO6-</b> Create various synthetic methodologies involved in organic synthesis.</p>
<b>MCHE 313</b>	<b>Bioinorganic, Bioorganic and Biophysical Chemistry</b>	<p><b>CO1-</b> Gain Knowledge about bioinorganic, bioorganic and biophysical chemistry.</p> <p><b>CO2-</b> Understand the basics of bioinorganic, bioorganic and biophysical chemistry.</p> <p><b>CO3-</b> Explain the role of metal ions in biological systems, transport and storage of oxygen.</p> <p><b>CO4-</b> Illustrate about mechanism of enzyme action and types of reaction catalyzed by enzymes, Na/K pump, biological cell and its constituent.</p> <p><b>CO5-</b> Summarize structure and functions of proteins, enzymes , nucleic acids and cell membrane.</p> <p><b>CO6-</b> Express standard free energy change in biological reactions, hydrolysis of ATP and its synthesis.</p>
<b>MCHE 315</b>	<b>Polymers</b>	<p><b>CO1-</b> Get Knowledge about synthesis, properties and applications of different polymers</p> <p><b>CO2-</b> Understand about different types of mechanisms in polymerization processes.</p> <p><b>CO3-</b> Explain the importance of functionality of polymers in polymerization.</p> <p><b>CO4-</b> Illustrate the properties of polymers with their structure.</p> <p><b>CO5-</b> Evaluate molecular weight of polymers by using different methods.</p> <p><b>CO6-</b> Write about processing of different type of polymeric products.</p>

<b>MCHE 317</b>	<b>Medicinal Chemistry</b>	<b>CO1-</b> Gain the knowledge of fundamentals of medicinal chemistry. <b>CO2-</b> Understand the drugs, antibiotics, enzymes etc . <b>CO3-</b> Apply an idea of antibiotics and their mechanism of action. <b>CO4-</b> Analyze the structure of enzymes and their interaction with biomolecules. <b>CO5-</b> Summarize the concept of medicinal chemistry. <b>CO6-</b> Generalize the concept of enzymes, antibiotics and their mechanism of action.
<b>MCHE 322</b>	<b>Instrumental methods of analysis</b>	<b>CO1-</b> Gain Knowledge about theory, instrumentation and applications of different electro-analytical methods. <b>CO2-</b> Differentiate between various electro-analytical techniques including cyclic voltametry, Vcoulometry, polarography etc. <b>CO3-</b> Determine morphology of materials using scanning electron microscopy and transmission electron microscopy <b>CO4-</b> Illustrate the theories, instrumentation and applications of high performance liquid chromatography and gas chromatography. <b>CO5-</b> Distinguish various types of thermal methods for characterization of different types of compounds. <b>CO6-</b> Design various types of chromatography techniques.
<b>MCHS 320</b>	<b>Pesticide Chemistry</b>	<b>CO1-</b> Gain the knowledge of fundamentals of pesticide chemistry. <b>CO2-</b> Understand the classification of pesticides. <b>CO3-</b> Apply and use self study for teaching practice. <b>CO4-</b> Analyze synthetic route of pesticides. <b>CO5-</b> Distinguish different type of pesticides. <b>CO6-</b> Design various synthesis of pesticides.
<b>MCHC 401</b>	<b>Chemistry of natural products</b>	<b>CO1-</b> Get Knowledge about the terpenoids, alkaloids, pigments and prostaglandins. <b>CO2-</b> Understand about the terpenoids, alkaloids, pigments and prostaglandins. <b>CO3-</b> Explain various types terpenoids, alkaloids, pigments and prostaglandins. <b>CO4-</b> Illustrate synthetic route of terpenoids, alkaloids, pigments and prostaglandins <b>CO5-</b> Compare different type reaction mechanism of terpenoids, alkaloids, pigments and prostaglandins synthesis <b>CO6-</b> Write about various synthetic routes of terpenoids, alkaloids, pigments and prostaglandins.
<b>MCHL 402</b>	<b>Laboratory Course I</b>	<b>CO1-</b> Define the use of spectroscopic techniques in structural determination of natural product <b>CO2-</b> Paraphrase about the isolations and purification of natural products and check their purity by Chromatography. <b>CO3-</b> Apply the use of spectroscopic techniques in structural determination of natural products. <b>CO4-</b> Analyze and comprehend the practical concepts in the identification of components for given organic mixtures. <b>CO5-</b> Recognize the practical concepts for organic mixture. <b>CO6-</b> Justify the isolation and purification of natural products by chromatography
<b>MCHC 403</b>	<b>Dissertation</b>	<b>CO1-</b> Learn basics to identify research problem. <b>CO2-</b> Explain research gap.



		<b>CO3-</b> Develop the methodology for experiments. <b>CO4-</b> Analyze experimental data. <b>CO5-</b> Defend thesis in presence of examiners. <b>CO6-</b> Write thesis and research papers
<b>MCHE 410</b>	<b>Computer and Biostatistics</b>	<b>CO1-</b> Define the simple model of computer, introduction to arrays, human mapping database, basics of biostats and test of hypothesis. <b>CO2-</b> Give examples the different tests, internet working, MS Office. <b>CO3-</b> Apply the different significance test in simple problems, correlation in daily problems, internet working and operating system in various fields. <b>CO4-</b> Explain the significance test, errors, human mapping data, computer languages. <b>CO5-</b> Evaluate the curve fitting problems, different tests and sample programs. <b>CO6-</b> Write the concept of OSI layers, basic data types, mapping data base, graphical representation of data and curve fitting.
<b>MCHE 411</b>	<b>Environmental Chemistry</b>	<b>CO1-</b> Get knowledge about the environment, its segments, and pollution. <b>CO2-</b> Understand the composition of the environment and the pollutants present in it. <b>CO3-</b> Explain the chemistry of water, soil and atmosphere. <b>CO4-</b> Focus on environmental toxicology and environmental pollution. <b>CO5-</b> To use practical approach for determination of different pollutants. <b>CO6-</b> Generalize the concept of pollution.

## Master of Science (M.Sc.)-Physics

### Programme outcome (POs)

#### Students will be able to

PO 1	Implement strong theoretical and practical knowledge of physics to solve complex scientific problems.
PO2	Identify the situation-based problems, formulation, and action is taken based on analytical thinking and principles of science.
PO3	Formulate, design, experimental techniques, scientific tools, analysis of scientific data, interpretation of data, and establish a hypothesis for various interdisciplinary research problems.
PO4	Execute effective communication through interactive and presenting skills, technical report writings, and proper documentation of ideas.
PO5	Create a new conceptual, theoretical and operational approach to address various problems in interdisciplinary fields.
PO6	Enables individuals to function effectively in cross-cultural environments as an individual, and as a member or leaders.
PO7	Understand the contribution of scientific knowledge in environmental contexts for sustainable development.
PO8	Understand ethical issues, academic and research ethics, the need and value of lifelong learning, and the scientific misconduct of a scientist to serve society.
PO9	Enhance and adopt employability skills through research, internship, and dissertation.
PO10	Successfully compete in the state level, national level, and international level exams or competitions.
PO11	Lifelong learning of knowledge of physics
PO12	Implement the learning of physics in project management and finance

### Program Specific Outcome (PSOs)

PSO 1	Associate the fundamental and advanced concepts in diverse branches of physics including classical mechanics, quantum mechanics, electrodynamics, statistical mechanics, atomic, nuclear, and particle physics, condensed matter physics, and electronics.
PSO2	Apply suitable methods to solve a wide range of problems and handle interdisciplinary projects as well as experimental data interpretation independently.
PSO3	Employ experimental skills for multi-disciplinary research work in cutting-edge areas of physics.
PSO4	Develop job-oriented analytical skills needed in research, consultancy, defense, entrepreneurial pursuit, and industry.

**Course Outcome (CO)**

<b>Course Code</b>	<b>Course Name</b>	<b>Outcome</b>
<b>MPHC101</b>	<b>Classical Mechanics</b>	<p><b>CO1-</b> Define and describe Lagrangian formulation, Variational Principle, Hamilton's formalism, principle of least action and mechanics of Rigid bodies and theory of small Oscillation.</p> <p><b>CO2-</b> Understand Lagrange's Equations, Hamilton's Variational Principle, Canonical Transformation, Hamilton's Formulation, principle of least action and mechanics of Rigid bodies, Conservation theorems.</p> <p><b>CO3-</b> Apply Lagrange's Equations, Hamilton's Formulation, Canonical transformation, Poisson brackets to various systems</p> <p><b>CO4-</b> Analyze constraints, degree of freedom, generalized coordinates, D'Alembert's principle, conservation theorems, Poisson brackets, mechanics of rigid bodies, theory of small Oscillation</p> <p><b>CO5-</b> Evaluate angular momentum, energy, moment of inertia, theorems on rigid body and applications of Lagrangian, Hamiltonian, canonical and Poisson's bracket formulation</p> <p><b>CO6-</b> Solve Problems on Lagrangian, Hamilton's formulation, Canonical transformation, Poisson's bracket, mechanics of Rigid bodies and theory of Oscillation.</p>
<b>MPHC102</b>	<b>Mathematical Physics</b>	<p><b>CO1-</b> Describe differential equations, group theory, partial differential equations, matrix and tensors and complex variable</p> <p><b>CO2-</b> Illustrate Special function (Bessel's, Legendre, Hermite functions, Laguerre functions), recurrence relations, Parity and orthogonality, Cauchy's integral theorem, Eigen Values-Eigen vectors, for solving definite integral, Laplace equation.</p> <p><b>CO3-</b> Understand Taylor and Laurent's expressions, residues at various poles, theorem of residues, Contour integration, partial differential equations using boundary value problems, wave and heat equation, two-dimensional heat equation</p> <p><b>CO4-</b> Explain Schur's Lemmas and orthogonality theorem and, isomorphism and homomorphism.</p> <p><b>CO5-</b> Distinguish covariant and contravariant Tensors use the group theory, Classification of groups</p> <p><b>CO6-</b> Solve the matrix and tensors, Coordinate transformation, vector spaces, representation theory of finite groups</p>
<b>MPHC103</b>	<b>Electrodynamics and Astrophysics</b>	<p><b>CO1-</b> Describe the Maxwell's equations and electromagnetic waves, Radiations from moving charges, stellar System, sun as a star, and the solar system</p> <p><b>CO2-</b> Discuss the formulation of Lienard Wiechert, Retarded potential and Hertzberg- Russell Diagram.</p> <p><b>CO3-</b> Illustrate Poynting's theorem and Maxwell's equations to solve problems of classical electrodynamics, the orbits Laws of planetary motion</p> <p><b>CO4-</b> Classify the concept of modern astrophysical</p>

		<p>observations, the photosphere, the solar atmosphere, Salient features of sunspot</p> <p><b>CO5-</b> Evaluate the understanding of our present picture of stellar system, Meteors and Meteorites, Atmospheric extinction. Absolute magnitudes and distance modulus</p> <p><b>CO6-</b> Express Nuclear fission, nuclear fusion, condition for nuclear reaction in stars, Structure and features of the Milky Way Galaxy, accelerated charged particle at low velocities in circular orbits-Larmor formula.</p>
<b>MPHC104</b>	<b>Electronics</b>	<p><b>CO1-</b> Define and describe Power amplifiers, Feedback amplifiers, Operational amplifiers, Optoelectronics and Optical detectors</p> <p><b>CO2-</b> Understand about Principle and working of different Power amplifiers, Feedback amplifiers, Operational amplifiers, Optoelectronics and Optical detectors</p> <p><b>CO3-</b> Illustrate and Explain various oscillators, multivibrators, optical fibers, LED, ILD, Optical Detectors, and applications of operational amplifiers.</p> <p><b>CO4-</b> Analyse the characteristics of power amplifiers, operational amplifiers, feedback amplifiers, various optical fibers and optical detectors.</p> <p><b>CO5-</b> Distinguish between different power amplifiers, oscillators, multivibrators operational amplifiers, feedback amplifiers, various optical fibers and optical detectors</p> <p><b>CO6-</b> Design various electronic circuits such as power amplifiers, oscillators, multivibrators, operational amplifiers, feedback amplifiers, various optical fibers and optical detectors for practical purposes.</p>
<b>MPHL105</b>	<b>Laboratory Course – I</b>	<p><b>CO1-</b> Recognize the set up and calibrate the experimental setup.</p> <p><b>CO2-</b> Describe the basic principles of experiments.</p> <p><b>CO3-</b> Illustrate the experiment, tabulate the readings and interpret the data by drawing graphs.</p> <p><b>CO4-</b> Analyse the readings and interpret the data.</p> <p><b>CO5-</b> Find errors in interpret the data</p> <p><b>CO6-</b> Examine the verification of in the study of phenomenon such as of Zeeman effect and interference pattern to calculate several physical parameters.</p>
<b>MPHL106</b>	<b>Laboratory Course – II</b>	<p><b>CO1-</b> Recognize the set up and calibrate the experimental setup.</p> <p><b>CO2-</b> Describe the basic principles of experiments.</p> <p><b>CO3-</b> Illustrate the experiment, tabulate the readings and interpret the data by drawing graphs.</p> <p><b>CO4-</b> Analyse the readings and interpret the data.</p> <p><b>CO5-</b> Find errors in interpret the data</p> <p><b>CO6-</b> Examine the verification of in the study of phenomenon such as amplifier and oscillator to calculate several physical parameters.</p>
<b>MPHC201</b>	<b>Atomic and Molecular Physics</b>	<p><b>CO1-</b> Describe the atomic spectra, atoms in electric and magnetic field, molecular spectroscopy and spin resonance.</p>

		<p><b>CO2-</b> Understand hydrogen spectra, rotational and vibrational spectra. Rotational and vibrational spectra of diatomic molecule</p> <p><b>CO3-</b> Apply coupling <math>jj</math> and L-S, rigid rotator, Zeeman effect, ESR and NMR. Franck-Condon principle, Condon parabola. Rotational fine structure of electronic-vibration transitions.</p> <p><b>CO4-</b> Analyse spectroscopic term, hyperfine structure and Raman spectroscopy. Spin-orbit coupling</p> <p><b>CO5-</b> Evaluate Born opp. Approximation, Pauli's exclusion principle, Stark effect, First order Stark effect in hydrogen, Parity,</p> <p><b>CO6-</b> Formulate Lande interval rule, electronic spectra. Hydrogen, Helium and Alkali spectra</p>
<b>MPHC202</b>	<b>Solid State Physics</b>	<p><b>CO1-</b> Describe the crystal structure and system of the solids, Reciprocal lattice, Crystal Binding and Elastic Constants, Lattice Vibrations</p> <p><b>CO2-</b> Understand diffraction waves by crystal, Bragg's law, elastic waves in cubic crystals, quantization of elastic waves, analysis of elastic springs, reciprocal lattice</p> <p><b>CO3-</b> Apply Laue's equations, Brillouin zones, group velocity. Vibrations of crystals with monoatomic basis, First Brillouin zone, Group Velocity, Long wavelength limit, Two atoms per primitive basis</p> <p><b>CO4-</b> Crystal structures, analyse elastic springs, phonon momentum, closed packed structure.</p> <p><b>CO5-</b> Evaluate fundamental types of lattice, Two atoms per primitive basis, packing factor</p> <p><b>CO6-</b> Express the ionic crystal, covalent crystal, metals, Bonding in solids, hydrogen bonds</p>
<b>MPHC203</b>	<b>Statistical Physics</b>	<p><b>CO1-</b> Describe Basic Postulates, Application of classical distribution to the ideal gases, Imperfect gases, Quantum Statistics, Black Body Radiation</p> <p><b>CO2-</b> Understand statistics, phase space, ensembles, fermi theory, liquid helium phase rule, absorption and emission of radiation, Einstein and Debye's theory of specific heat of solids.</p> <p><b>CO3-</b> Examine partition function, Sackur tetrode equation, B.E condensation principle, Wein's displacement formula, Gibb's paradox, Liouville's theorem</p> <p><b>CO4-</b> Deduce Stefan's law, ensembles, pressure energy relationship, Rayleigh Jean's formula, general properties of liquids, Statistical equilibrium</p> <p><b>CO5-</b> Evaluate partition functions, virial coefficients, Planck's distribution, pressure and energy relationship of photons, Phase space</p> <p><b>CO6-</b> Formulate Gibb's paradox, degenerate cases, specific heat of solids, Vander Waal constant and Virial coefficient</p>
<b>MPHC204</b>	<b>Quantum Mechanics</b>	<p><b>CO1-</b> Define and describe basic postulates of quantum mechanics, Matrix Formulation and symmetry in Quantum Mechanics, Approximation Methods for Bound State</p>

		<p><b>CO2-</b> Understand Schrodinger equation, potential problems, Time independent and Time-dependent perturbation theory, Matrix Formulation and symmetry in Quantum Mechanics</p> <p><b>CO3-</b> Apply Schrodinger equation and different approximation methods in various systems and explain Clebsch-Gordon coefficients,</p> <p><b>CO4-</b> Analyse various operators, Fermi Golden Rule, Semi-classical treatment of radiation. Einstein coefficients, Zeeman effect, Pauli spins matrices, Poisson brackets and commutation relations</p> <p><b>CO5-</b> Evaluate commutation relations, eigenvalues, first order Stark effect in hydrogen atom, WKB approximation</p> <p><b>CO6-</b> Solve the problem One dimensional potential step, tunnelling, Hydrogen atom, particle in a three-dimensional box and applications of Variation principle, time dependent and independent perturbations.</p>
<b>MPHL205</b>	<b>Laboratory Course – I</b>	<p><b>CO1-</b> Recognize the set up and calibrate the experimental setup.</p> <p><b>CO2-</b> Describe the basic principles of experiments.</p> <p><b>CO3-</b> Illustrate the experiment, tabulate the readings and interpret the data by drawing graphs.</p> <p><b>CO4-</b> Analyse the readings and interpret the data.</p> <p><b>CO5-</b> Find errors in interpret the data</p> <p><b>CO6-</b> Examine the verification of in the study of phenomenon such as of amplifier and B-H curve to calculate several physical parameters.</p>
<b>MPHL206</b>	<b>Laboratory Course – II</b>	<p><b>CO1-</b> Recognize the set up and calibrate the experimental setup.</p> <p><b>CO2-</b> Describe the basic principles of experiments.</p> <p><b>CO3-</b> Illustrate the experiment, tabulate the readings and interpret the data by drawing graphs.</p> <p><b>CO4-</b> Analyse the readings and interpret the data.</p> <p><b>CO5-</b> Find errors in interpret the data</p> <p><b>CO6-</b> Examine the verification of in the study of phenomenon such as of modulation and demodulation and magnetic susceptibility pattern to calculate several physical parameters.</p>
<b>MPHC301</b>	<b>Advanced Quantum Mechanics</b>	<p><b>CO1-</b> Define and describe scattering theory, identical particles, Relativistic Wave Equations, Quantization of wave fields</p> <p><b>CO2-</b> Understand various scattering techniques for low and high energy particles, , Klein-Gordon equation, Dirac equation formulation, theory of identical particles, Quantization of wave fields</p> <p><b>CO3-</b> Apply partial wave and Born approximation techniques to various systems, K-G and Dirac equation, Pauli's exclusion principle to different systems.</p> <p><b>CO4-</b> Analyse theory of identical particles, Pauli's exclusion principle, second quantization, Covariance of Dirac equation, scattering amplitude, differential and total cross section and Green's function for scattering.</p>

		<p><b>CO5-</b> Evaluate the problems based on partial wave and Born approximation. Distinguish between Lab. Frame and center of mass frame</p> <p><b>CO6-</b> Formulate and develop understanding on theory of identical particles, N-representation, creation and annihilation operators, electron spin and magnetic moment, negative energy sea, hole interpretation and the concept of positron</p>
<b>MPHC302</b>	<b>Nuclear Physics</b>	<p><b>CO1-</b> Describe the general properties &amp; models, nuclear forces and detector, radioactive decay, nuclear reactions</p> <p><b>CO2-</b> Explain the binding energy, Liquid drop model, Shell model magic number and spin parity related to shell model, Low energy neutron-proton scattering and proton-proton scattering, Exchange and tensor forces</p> <p><b>CO3-</b> Illustrate the Gamow's theory of alpha decay and Geiger Nuttall law, Fermi's theory of beta decay, parity violation in beta decay, radioactive decay, various decay phenomena and their process</p> <p><b>CO4-</b> Analyze the nuclear size, nuclear angular momentum (Spin), Nuclear magnetic moments, statistic, the principle and application of G.M counter and synchrotron.</p> <p><b>CO5-</b> Evaluate the Q-value of nuclear reaction, parity violation in beta decay, electromagnetic decays. Ground state of deuteron</p> <p><b>CO6-</b> Express the stimulation Electron &amp; Proton Synchrotron, Nuclear magnetic moments, Binding energy</p>
<b>MPHC303</b>	<b>Seminar</b>	<p><b>CO1-</b> Remember scientific information.</p> <p><b>CO2-</b> Develop and understand quality scientific presentation.</p> <p><b>CO3-</b> Present and explain and apply scientific information.</p> <p><b>CO4-</b> Classify and analyze scientific work for presentation.</p> <p><b>CO5-</b> Evaluate scientific information and then analyse it.</p> <p><b>CO6-</b> Develop scientific understanding towards research oriented topics</p>
<b>MPHE304</b>	<b>Condensed Matter Physics</b>	<p><b>CO1-</b> Describe the defects in crystals and magnetism energy bands, Superconductivity Energy, Defects in crystals and Magnetism, dielectrics and ferroelectrics, Nano Material Science and Technology</p> <p><b>CO2-</b> Express the magnetic and dielectric properties of the solids, Quantum well &amp; application, Nearly free electron model, One dimensional free electron case,</p> <p><b>CO3-</b> Determine the defects present in the crystals, destruction of superconductivity by magnetic field and temperature, Meissner effects, Type-I and Type-II superconductors, Isotope effect, Thermodynamics of Superconducting transition, Classify BCS Theory related to Superconductor.</p> <p><b>CO4-</b> Analyse the Complex dielectric constant, History, Origin, Quantum dots, Synthesis, Applications and advantages, Quantum wires, Quantum well</p> <p><b>CO5-</b> Evaluate Nanotechnology, ferroelectric domains, piezoelectricity, High temperature superconductors.</p>



		CO6-	Express the nanobuds, carbon nanotubes as quantum wires, critical fields and critical currents, Colour centres, F-Centre, V-Centre, dislocation.
MPHE305	Digital and Communication Electronics	CO1-	Describe Boolean Algebra ,Logic Gates & Combinational Circuits, Sequential Circuits, Modulation & Demodulation, Transmission Lines, Modulation, Radar Systems
		CO2-	Explain the flip flops, counter, register and its logic circuit, antenna, RADAR, TL Equations and their solutions, characteristic impedance
		CO3-	Determine the application of modulation and demodulation techniques, Principle of Radar, Basic arrangement of Radar system, Registers & Counters, Logic Gates
		CO4-	Illustrate modulation, Demodulation, Multiplexer, Demultiplexer, Encoder, Decoder, transmitters and receivers, Adder and Subtractor
		CO5-	Evaluate the Hertz antenna, Yagi antenna, loop antenna, direction finding, Resonant & Non resonant Antenna, Registers, Asynchronous and Synchronous Counters, Adders and Subtractors.
		CO6-	Express the Logic Gates, Ring counters, use of K-map to simplify the Boolean algebra expression, Excess 3 code
MPHE306	Laser Physics	CO1-	Describe the Basic principles and modulators, Types of lasers, Optical sources and detectors, Non- linear optics and Fiber optics, and Laser spectroscopy Holography
		CO2-	Illustrate the Gas lasers, He-Ne, argon ion, N <sub>2</sub> , CO <sub>2</sub> lasers; dye lasers, solid state, Semiconductor lasers: Ruby, Nd:YAG and Nd:glass lasers, diode lasers
		CO3-	Explain Laser interferometry, PIN photodiodes and modulator, Basic principles and theory of absorption and emission of radiation, Einstein's coefficients, line-broadening mechanisms, rate equations for three and four level laser systems, population inversion
		CO4-	Analyse the photo detector, LED etc. for practical purposes, optical fiber, LED structures, liquid crystal diodes, photoelectric, photovoltaic and photoconductive methods of detection of light
		CO5-	Evaluate Distinguish laser interferometry, PIN photodiodes, Electro optic effect, photo acoustic and photon electron spectroscopy, stimulated Raman spectroscopy, Coherent anti-stokes Raman spectroscopy
		CO6-	Express various applications of laser in research field, Einstein's coefficients, Design considerations of a fiber optical communication system, analogue and digital modulation, optical fiber amplifiers
MPHE307	Astrophysics	CO1-	Describe the Physics of the Stars, Fundamental Equations, Detectors, Photometry and Spectroscopy, Galactic System and Extragalactic Systems, Super dense Objects, Gravitation & Cosmology
		CO2-	Explain the stellar evolution, the concept of Black holes, Statistical parallaxes. Solar motion and its determination. Peculiar velocities. Single and Two-star stream

		<p>hypothesis. Velocity ellipsoid. Comparison with solar neighbourhood. Bottlinger's diagram. HR diagram.</p> <p><b>CO3-</b> Explain the types of binary stars, Design and construction of telescope Stability of white dwarfs. Final cooling of white dwarfs. Accretion by white dwarfs and its consequences. Pressure ionisation and mass-radius relation for cold bodies</p> <p><b>CO4-</b> Analyse the classify stellar energy and mass distribution in research field, Einstein's field equations, observational tests of general relativity. Models of the universe: Steady State Models. Standard Model: The expanding universe, Hubble's law. Microwave background radiation</p> <p><b>CO5-</b> Friedman-Robertson-Walker models, the early universe Distinguish Mass and radius relation, Galactic Structure, Mechanism of Mass transfer in Binary Stars. Use of polytropic models for completely degenerate stars. Mass-radius relation.</p> <p><b>CO6-</b> Express Non-degenerate upper layers and abundance of Hydrogen. Stability of white dwarfs, Determination of the masses and extragalactic distances, Galaxy Interaction</p>
<b>MPHE308</b>	<b>High Energy Physics</b>	<p><b>CO1-</b> Describe the classical and quantum field equations, quantization of fields and Renormalization of QED, Scattering Matrix and Feynman Rules, Color gauge invariance and QCD, Weinberg- Salam theory of electroweak unification</p> <p><b>CO2-</b> Discuss the application of scattering Matrix and Feynman Rules the quantization of fields, Global and Local gauge invariance, Electron- Positron scattering, Coulomb scattering of Electrons, electron – positron annihilation, Compton scattering. Symmetries and conservation laws, Norther's Theorem</p> <p><b>CO3-</b> Compute Classical Lagrangian and Hamiltonian Equations Quantum Equations, Fermion Mass generation. The classic predictions of SU (5) Grand Unified, Theory, quark and Lepton masses, Kobayashi-Maskawa matrix and CP violation</p> <p><b>CO4-</b> Analyze area of high energy physics, classical predictions of SU The SO(N), The SO (10) Grand Unified Theory, Fermion Masses in SO (10), Neutrino Mass in SO (10)</p> <p><b>CO5-</b> Discriminate Cabibbo Angle, Complex Field, Quantization of the Non-relativistic Schrodinger , Fermions Masses , quark and Lepton masses, Creation and Destruction Operators, Number Operators, Anti-commutation Relations, Equations of Motion, Physical Implications of Anti-commutation, Representation of Anti-commuting operators</p> <p><b>CO6-</b> Express Interaction Lagrangian for the fields, QED Lagrangian, Number Operators, Symmetries and conservation laws</p>
<b>MPHL 309</b>	<b>Laboratory Course</b>	<p><b>CO1-</b> Recognize the set up and calibrate the experimental setup.</p>

		<p><b>CO2-</b> Describe the basic principles of experiments.</p> <p><b>CO3-</b> Illustrate the experiment, tabulate the readings and interpret the data by drawing graphs.</p> <p><b>CO4-</b> Analyse the readings and interpret the data.</p> <p><b>CO5-</b> Find errors in interpret the data</p> <p><b>CO6-</b> Examine the verification of in the study of phenomenon such as Condensed Matter Physics Electronics/ Laser Physics/ Astrophysics to calculate several physical parameters.</p>
<b>MPHS310</b>	<b>Physics of Nano Materials</b>	<p><b>CO1-</b> Describe the nanoparticles: Synthesis and Properties, carbon nano structures, carbon nano Structures, Quantum Wells, Wires and Dots, Bulk Nano Structure Materials</p> <p><b>CO2-</b> Understand the synthesis and properties of nanomaterials, Carbon Nano Structures, Quantum Wells, Wires and Dots, Bulk Nano Structure Materials</p> <p><b>CO3-</b> Apply Nanoscience and Nanotechnology in modern device applications and in various fields</p> <p><b>CO4-</b> Analysis of various properties of nanomaterial by using different techniques</p> <p><b>CO5-</b> Evaluate the Different properties of nanomaterial for various fields.</p> <p><b>CO6-</b> Develop nanomaterials for various field applications, Methods of Synthesis, Solid Disorders Nano Structures, Mechanical Properties, Nano Structure Multilayers</p>
<b>MPHS311</b>	<b>Quantum Electrodynamics</b>	<p><b>CO1-</b> Define and describe Dirac equations, operators, K-G Equation, Second quantization Rutherford Scattering and Compton scattering, matrix Mechanics.</p> <p><b>CO2-</b> Understand Quantisation of electromagnetic field Rutherford Scattering and Compton scattering,</p> <p><b>CO3-</b> Explain Feynman graphs for different interactions, - matrix and its expansion</p> <p><b>CO4-</b> Classify scattering phenomenon, Feynman's theory of Position, Second quantization of Klein Gordon field, interaction fields.</p> <p><b>CO5-</b> Evaluate Matrix and Feynman Rules, Dirac (interaction) picture, Properties of Dirac Matrices</p> <p><b>CO6-</b> Solve Creation and annihilation operators, commutation relation, Projection Operators, Traces, cross sections using Feynman graphs.</p>
<b>MPHC401</b>	<b>Computational Physics</b>	<p><b>CO1-</b> Define and describe Roots of functions, Eigenvalues and eigenvectors of matrices, interpolation, Flowchart and algorithms, basics of C-Programming.</p> <p><b>CO2-</b> Understand interpolation, numerical integration methods, Flowchart and algorithms, C-Programming. Eigenvalues and eigenvectors of matrices,</p> <p><b>CO3-</b> Apply Roots of functions, Runge-Kutta Method, numerical integration, C-Programming methods to various problems.</p> <p><b>CO4-</b> Analyse the various interpolation methods, matrix inversion methods, Flowchart and algorithms, C-Programming to apply in various problems</p>

		<p><b>CO5-</b> Evaluate problems based on Roots of functions, Runge-Kutta Method, numerical integration, interpolation, Flowchart and algorithms, C-Programming</p> <p><b>CO6-</b> Formulate data types, operators, loops, arrays, pointers, Strings, input-output in C-Programming. Solve problems based on Gauss Jordan, Jacobi, Gaussian elimination, Gauss-Seidel method</p>
<b>MPHC402</b>	<b>Particle Physics</b>	<p><b>CO1-</b> Define Elementary Particles, Conservation of Energy, Fundamental Interaction Quark Model</p> <p><b>CO2-</b> Illustrate classification of elementary particles, CPT theorem, Global and Local gauge invariances, Evidences for Quarks, field quanta. Their general properties</p> <p><b>CO3-</b> Determine Quarks as building blocks of hadrons, Lepton No., Baryon No. Isospin, Hypercharge, Parity, Strangeness, Charge conjugation</p> <p><b>CO4-</b> Analyse Electromagnetic, Strong and Weak Nuclear interactions. General idea of Electro-weak and Grand unifications.</p> <p><b>CO5-</b> Evaluate Quark compositions of Mesons and Baryons. General idea of Standard Model. Idea of Higgs Boson.</p> <p><b>CO6-</b> Formulate Eight fold way, six quarks (u,d,s,c,t and b), Antiquarks.</p>
<b>MPHL 403</b>	<b>Laboratory Course</b>	<p><b>CO1-</b> Recognize the set up and calibrate the experimental setup.</p> <p><b>CO2-</b> Describe the basic principles of experiments.</p> <p><b>CO3-</b> Illustrate the experiment, tabulate the readings and interpret the data by drawing graphs.</p> <p><b>CO4-</b> Analyse the readings and interpret the data.</p> <p><b>CO5-</b> Find errors in interpret the data</p> <p><b>CO6-</b> Examine the verification of in the study of phenomenon such as of modulation and demodulation and magnetic susceptibility pattern to calculate several physical parameters.</p>
<b>MPHD404</b>	<b>Dissertation</b>	<p><b>CO1-</b> Observe practical experience of the research process.</p> <p><b>CO2-</b> Understands the principles of research</p> <p><b>CO3-</b> Apply principles of research design to solve the problems in the field of research.</p> <p><b>CO4-</b> Create, analyse and critically evaluate various research solutions.</p> <p><b>CO5-</b> Evaluate links between theory and methods within their field of study</p> <p><b>CO6-</b> Create various research solution.</p>
<b>MPHS 405</b>	<b>Environmental Physics</b>	<p><b>CO1-</b> Define the essentials of environmental physics, solar and terrestrial, Environmental Pollution and Degradation, Environmental Changes and Remote Sensing, Laws of motion. Global and regional Climate</p> <p><b>CO2-</b> Describe Energy and momentum in Nature, Ozone depletion problem, I R absorption, Elementary fluid dynamics, Physics of Radiation, Interaction of light with matter, Rayleigh and Mie scattering, laws of radiation (Kirchhoff's law, Plank's law, Wien's displacement law etc.)</p>

		<p><b>CO3-</b> Apply laws of radiation, Waste Disposal, Physics of Radiation, Energy sources and combustion processes. Renewable Sources of energy: Solar energy, wind energy</p> <p><b>CO4-</b> Analyse and deduce hydrostatic equilibrium, Diffusion, hydropower, fuel cells, Solar energy, wind energy, bioenergy.</p> <p><b>CO5-</b> Evaluate Gaseous and particulate matters, wet and dry deposition, Green House Effect,</p> <p><b>CO6-</b> Develop understanding and Express Energy sources and combustion processes, Turbulence and turbulent diffusion.</p>
<b>MPHS 406</b>	<b>Bio Physics</b>	<p><b>CO1-</b> Describe Molecular Organization, Nucleic acids and their organization in living cells.</p> <p><b>CO2-</b> Understand about absorption and emission Spectroscopy of bio molecules.</p> <p><b>CO3-</b> Illustrate about separation and Characterization of bio molecules using centrifugal, electrophoretic and chromatographic techniques.</p> <p><b>CO4-</b> Establishes the applications of isotopes in biological studies.</p> <p><b>CO5-</b> Evaluate applications of visible, UV, IR, NMR, ESR and MS Spectroscopy.</p> <p><b>CO6-</b> Formulate CD, ORD &amp; Fluorescence Spectroscopy, Raman Spectroscopy, Separation.</p>

## Master of Science (Microbiology)

### Programme outcome (POs)

The student will be able to:

<b>PO 1</b>	Implement strong theoretical and practical knowledge of microbiology to solve complex scientific problems.
<b>PO2</b>	Identify the situation-based problem, formulation and action is taken based on analytical thinking and principles of science.
<b>PO3</b>	Execute effective communication through interactive and presenting skills, technical report writings and proper documentation of ideas.
<b>PO4</b>	Formulate, design, experimental techniques, scientific tools, analysis of scientific data, interpretation of data and established hypothesis for various inter disciplinary research problems.
<b>PO5</b>	Create a conceptual, theoretical and operational approach to address various problems of inter disciplinary fields.
<b>PO6</b>	Enables individual to function effectively in cross-cultural environments as an individual and as a member or leader.
<b>PO7</b>	Understand ethical issues, academics and research ethics need and value of life long learning, scientific misconduct of a scientist to serve society.
<b>PO8</b>	Understand the contribution of scientific knowledge in environmental concept for sustain able development.
<b>PO9</b>	Enhance and adopt employability skills through research, internship and dissertation.
<b>PO10</b>	Successfully compete in the state level, national level and international level or competition
<b>PO11</b>	Demonstrate ability for collaborative research and scientific communication through projects, internship and onsite training.
<b>PO12</b>	Develop Skills required for higher education, professional development and employability.

### Program Specific Outcome (PSOs)

<b>PSO 1</b>	Associate the fundamental and advanced concept in diverse branches of Microbiology including Medical Microbiology, Agricultural Microbiology, Food Microbiology, RDT, Bioinformatics and Industrial Microbiology.
<b>PSO2</b>	Formulate, design, experimental technique, scientific tools, analysis of scientific data interpretation of data and establish a hypothesis for various interdisciplinary research problems.
<b>PSO3</b>	Capable of executing short research projects / patent incorporating various tools and techniques in any of the basic specializations of Microbiology.
<b>PSO4</b>	Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

### Course Outcome (CO)

Course Code	Course Name	Outcome
MMBC 101	Introductory Microbiology	<p><b>CO1-</b> Define the terminology and describe about History and Classification, Basics of Microbiology, General Bacteriology, General Virology and mycology, Extremophiles.</p> <p><b>CO2-</b> Explain and express diagrammatically where required about history, scope, classification and techniques used in microbiology, microbial nutrition, culture media and microbial growth. Bacterial structure and reproduction, viral characteristics, classification, structure, genome, isolation and cultivation, Infectivity assay and lytic and lysogenic cycle and basic study of mycology and extremophiles.</p> <p><b>CO3-</b> Write and illustrate diagrammatically where applicable about history, classification and basics of microbiology, Details of General Bacteriology, General Virology, Mycology and General introduction to Archae bacteria and applications Tools used for studying extremophiles.</p> <p><b>CO4-</b> Explain about history, scope, classification and techniques used in microbiology, microbial nutrition, culture media and microbial growth. Bacterial structure and reproduction, viral characteristics, classification, structure, genome, isolation and cultivation, Infectivity assay and lytic and lysogenic cycle and basic study of mycology and extremophiles.</p> <p><b>CO5-</b> Summarize the aspect of Basic microbiology, Bacteriology, Virology, Mycology and Extremophiles.</p> <p><b>CO6-</b> Revise the concept of Introductory Microbiology.</p>
MMBC 102	Principles of Biochemistry	<p><b>CO1-</b> Describe the biomolecule, carbohydrate, protein, lipid, with reference to enzyme structure, function and mechanism and concept of Bioenergetics.</p> <p><b>CO2-</b> Understand about free energy, ATP synthesis, and types and function of carbohydrates, protein, lipid and enzymes.</p> <p><b>CO3-</b> Illustrate the concept of free energy, and amino sugar, peptide bond in protein, nitrogen fixation and nomenclature of enzyme.</p> <p><b>CO4-</b> Compare the carbohydrates, amino acid, lipids and the mechanism of action of enzyme.</p> <p><b>CO5-</b> Know about structure and functions of nucleotides; physiology of nitrogen fixation</p> <p><b>CO6-</b> Justify Enzyme nomenclature, features and classification of amino acids, Lipid functions, Basics of Bioenergetics etc.</p>
MMBC 103	Cell and Molecular Biology	<p><b>CO1-</b> Define Intracellular Compartmentalization of Cell, cell signaling, replication, protein synthesis and cell cycle with reference to cell death.</p> <p><b>CO2-</b> Summarize the types of cell organelles and cell signaling, mode of replication, transcription and Translation process</p>



		<p>in cell, Gene regulation , Mitosis and meiosis ,types of cell death.</p> <p><b>CO3-</b> Explain the various cell organelles and function, method of signaling, Evidence and mechanism of Replication, protein synthesis in Prokaryotes and Eukaryotes, Types of cell division and cell death.</p> <p><b>CO4-</b> Explain Structure ,organization and functions of cell organelles, process of cell signaling .Protein synthesis process in Prokaryotes and Eukaroyes, Types of Gene Regulation,</p> <p><b>CO5-</b> Summarize the function of cell organelles, role of signal molecule in cell,Protein synthesis in Pro-and Eukaroytes with post transcriptional and translational modification.Control of gene expression .Phases of cell cycle and mechanism of cell death.</p> <p><b>CO6-</b> Justify cell organelles, cell cycle, signaling, protein synthesis and gene regulation and cell death.</p>
MMBC 104	Microbial Genetics	<p><b>CO1-</b> Memorize the terms used in genetics</p> <p><b>CO2-</b> Discuss the molecular mechanism underlying mutation, recombination, transposition, DNA damage and repair.</p> <p><b>CO3-</b> Identify role of plasmids and bacteriophages in transformation, conjugation and transduction</p> <p><b>CO4-</b> Correlate the knowledge of genes with development of resistance, gene location and model organism.</p> <p><b>CO5-</b> Summarize different types of plasmids and life cycles of bacteriophages and gene transfer mechanism</p> <p><b>CO6-</b> Write about different models of recombination, types of mutation, transposable elements and DNA repair.</p>
MMBL 105	Lab Course <b>CO5-I</b>	<p><b>CO1-</b> Define safety rules of working in lab, sterilization techniques and state the principle and working of instruments. Enumeration of bacteria and fungi from given sample.</p> <p><b>CO2-</b> Estimate quantitatively and qualitatively sugar, protein and lipid in given sample and Identify different types of bacteria and fungi on the basis of different staining techniques.</p> <p><b>CO3-</b> Preparation of media, solution and buffers</p> <p><b>CO4-</b> Calculation of moles, molarity, molality and normality and pH of given solution.</p> <p><b>CO5-</b> Assess characteristic features of algae and symptoms of infection of plant pathogen.</p> <p><b>CO6-</b> Prepare and maintain pure culture of bacteria.</p>
MMBL 106	Lab Course II	<p><b>CO1-</b> Identify different stages of cell cycle.</p> <p><b>CO2-</b> Isolate genomic DNA of bacteria and antibiotic resistant bacteria.</p> <p><b>CO3-</b> Demonstrate the process of mutagenesis, photo reactivation, transformation and conjugation.</p> <p><b>CO4-</b> Analyze the effect of environmental stress on denaturation of DNA. Estimate the quantity of DNA.</p> <p><b>CO6-</b> Prepare slides of mitosis and meiosis and competent cell.</p>
MMBC 201	Microbial	<b>CO1-</b> Define microbial photosynthesis and chemolithotrophy,

	Physiology and Metabolism	<p>nitrogen and sulfur metabolism in bacteria, microbial respiration and fermentation, bacterial permeation, and Microbial stress.</p> <p><b>CO2-</b> Summarize the photosynthetic microorganism and its function, chemolithotrophs, Nitrogen fixation and Sulphur metabolism in bacteria, mechanism of Microbial Respiration. Structure and organization of membrane, Osmotic stress and osmoregulation in Microorganism.</p> <p><b>CO3-</b> Explain Aerobic respiration and Anaerobic respiration in bacteria, fermentation pathway in microorganism. Structure and organization of membrane, Response of bacteria in stress condition.</p> <p><b>CO4-</b> Explain Photosynthetic electron transport system, Characteristic features of chemolithotrophs, Characteristics, biochemistry and mechanism of nitrogen fixing bacteria, various sulphur metabolism pathway in Microorganism, Mechanism of microbial stress response in microorganism.</p> <p><b>CO5-</b> Summarize the Microbial Photosynthesis, Mechanism of photosynthesis in microorganism, Respiration and Fermentation pathway in microorganism, Cell membrane pathway in bacteria, Different type of stress in bacteria.</p> <p><b>CO6-</b> Justify Phototrophs and chemotrophs, role of nitrogen fixing bacteria in nitrogen fixation process, sulphur metabolism process, Aerobic and anaerobic respiration in bacteria, Role of bacteria in fermentation pathway, Transport system in bacteria, Regulation of Microbial stress and mechanism in bacteria.</p>
MMBC 202	Immunology	<p><b>CO1-</b> Define the terms used in immune system, Antigen and antibody, complement system and MHC, immune response and medical applications of immunology.</p> <p><b>CO2-</b> Discuss and differentiate between cells of the immune system, types of immunity and immune response, antigens and antibodies. Explain role of complement system in immune response, MHC and medical applications of immunology.</p> <p><b>CO3-</b> Write about the basic concept of immunity and immune system, Explain with diagrams antigen –its properties, types and functions and antibodies, its types and functions, complement component, pathways etc. MHC, Transplantation, immune response and regulation and immunopathology.</p> <p><b>CO4-</b> Illustrate and diagrammatically explain cells of the immune system, Explain types of immunity and immune response, concept of antigen and antibodies, MHC, complement system and its activation pathways, transplantation, immune response and regulation and medical applications of immunology.</p> <p><b>CO5-</b> Summarize along with diagrams the concept of immune system, antigens, antibodies, complement system and MHC, transplantation, immune response and regulation and</p>

		<p>medical applications of immunology.</p> <p><b>CO6-</b> Generalize the concept of Immunology</p>
MMBC 203	Biological Techniques	<p><b>CO1-</b> Define basic principle of laboratory Instruments, Microscopy and Biosensors , Chromatography , electrophoresis, Spectroscopy and Radioisotop.</p> <p><b>CO2-</b> Summarize the principals and function of laboratory Instruments , Microscopy and Biosensors , Theory, principle and applications of chromatography, Basic principles and applications of electrophoresis and spectroscopy. Applications of radioisotopes in biology</p> <p><b>CO3-</b> Explain application and principle of laboratory instruments, Introduction and principles of Microscopy and biosensors, Theory, principle and applications of chromatography, Basic principles and applications of electrophoresis, Elementry idea of spectroscopy. Radiotracer techniques.</p> <p><b>CO4-</b> Explain principles of Instruments, Types of biosensor and Microsopy, principle and applications of electrophoresis, principle and applications of radioisotopes.</p> <p><b>CO5-</b> Summarize the principles and types of Ph meter, Laminar air flow and centrifugation, Applications of radioisotopes in biology</p> <p><b>CO6-</b> Justify basic laboratory Instruments , function of microscopy and biosensor, principle and applications of chromatography , Applications of radioisotopes in biology.</p>
MMBC 204	Recombinant DNA Technology	<p><b>CO1-</b> Describe principles, tools, techniques and strategies used in gene cloning and genome analysis.</p> <p><b>CO2-</b> Elucidate the molecular techniques involved in gene manipulation and rDNA technology</p> <p><b>CO3-</b> Explain the concept of vectors and gene transfer methods for the production of transgenic plants and animals.</p> <p><b>CO4-</b> Appreciate the techniques used in genome analysis and their applications.</p> <p><b>CO5-</b> Summarize the role of vectors in gene cloning and expression.</p> <p><b>CO6-</b> Develop understanding of sequence detection, gene amplification, modification and genome analysis techniques and also applications of RDT.</p>
MMBL 205	Lab Course I	<p><b>CO1-</b> Observe the biochemical characterization of bacteria</p> <p><b>CO2-</b> Observe the effect of pH, sugars,amino acids and inorganic ions on spore germination.</p> <p><b>CO3-</b> Determine the effect of mechanism of diffusion and osmosis on cell</p> <p><b>CO4-</b> Separation of blood components.</p> <p><b>CO5-</b> Perform test for the presence of specific antibody for its antigen by Dot-ELISA</p> <p><b>CO6-</b> Serological test for the given blood/serum sample.</p>
MMBL 206	Lab Course II	<p><b>CO1-</b> Identify and separate amino acid and sugars by chromatographic techniques.</p>

		<b>CO2-</b> Interpret molecular weight of DNA by gel electrophoresis techniques. <b>CO3-</b> Demonstrate isolation of genomic and plasmid DNA and visualize by electrophoresis <b>CO4-</b> Verify Lambert Beer's law. <b>CO5-</b> Perform restriction digestion and amplification of DNA. <b>CO6-</b> Prepare competent cells.
MMBC 301	Medical Microbiology	<b>CO1-</b> Define Normal microbiota of human body, pathogenesis, Antimicrobial Chemotherapy, Bacterial Diseases , Viral and Fungal Diseases. <b>CO2-</b> Summarize the role of resident flora and human host, Pathogenicity islands, drug susceptibility testing, bacterial diseases and clinical syndromes, control of viral diseases. <b>CO3-</b> Explain the normal microflora in human, mechanism of pathogenesis, methods of drug susceptibility testing, transmission, characteristics of causative organism, pathogenesis, laboratory diagnosis, prevention and control of bacterial ,viral and fungal disease. <b>CO4-</b> Explain infection and pathogenicity, role of microorganism in human flora, various method of drug susceptibility testing, different bacterial diseases ,prevention and control, transmission, pathogenesis, laboratory diagnosis, prevention and control of fungal diseases. <b>CO5-</b> Summarize the role of resident flora and human host, Pathogenicity islands, methodology of drug susceptibility testing, various bacterial, viral and fungal disease . <b>CO6-</b> Justify the routes of transmission of pathogens, how to bacteria enter the host, Methods of drug susceptibility testing, pathogenesis , treatment and control of bacterial ,viral and fungal diseases.
MMBC 302	Industrial and Pharmaceutical Microbiology	<b>CO1-</b> Define Basic Aspects of Fermentation , Introduction to Industrial Microbiology, Antibiotic production and Quality Assurance and Validation <b>CO2-</b> Summarize basic structure and function of fermenter , fermentation, strain improvement and QA and QC <b>CO3-</b> Write about fermentation, concept of strain improvement, antibiotic production and Guidelines for QA and QC ,(GMP)and (GLP)in pharmaceutical industry. <b>CO4-</b> Explain the basic concept of fermenter , Strategies for strain improvement:, Production of antibiotic and Quality Assurance and Validation. <b>CO5-</b> Summarize the concept of Industrial and Pharmaceutical Microbiology. <b>CO6-</b> Compile and write about the study of Industrial and Pharmaceutical Microbiology.
MMBE 303a	Food and Dairy Microbiology	<b>CO1-</b> Define Principles of Food Preservation, canning, Contamination and Spoilage, Foodborne Infections and Intoxications, Food Safety and Quality

		<p>Assurance, Production of Fermented Foods, alcoholic beverages, probiotics and genetically modified foods.</p> <p><b>CO2-</b> Describe principles and methods of Food Preservation, factors influencing microbial growth, Characterization of contamination and spoilage of different food products, Explain and differentiate between Bacterial and non-bacterial infections and intoxications, Food Safety and Quality Assurance, Industrial production methods of fermented foods, Alcoholic beverages. Explain Probiotics and genetically modified foods.</p> <p><b>CO3-</b> Write about Principles of Food Preservation, canning, Contamination and Spoilage, Foodborne Infections and Intoxications, Food Safety and Quality Assurance, Production of Fermented Foods, alcoholic beverages, probiotics and genetically modified foods.</p> <p><b>CO4-</b> Explain the detailed understanding about Principles of Food Preservation, canning, Contamination and Spoilage, Foodborne Infections and Intoxications, Food Safety and Quality Assurance, Production of Fermented Foods, alcoholic beverages, probiotics and genetically modified foods.</p> <p><b>CO5-</b> Summarize the concept of food and dairy microbiology</p> <p><b>CO6-</b> Compile and write about the study of food and dairy microbiology.</p>
MMBE 303b	Drug Designing and Nanno biotechnology	<p><b>CO1-</b> Learn about the basics of drug designing and nanotechnology</p> <p><b>CO2-</b> Discuss the methods of drug receptor interaction, drug targeting and drug delivery system.</p> <p><b>CO3-</b> Appreciate the use of nanoparticles in the field of drug designing and biotechnology.</p> <p><b>CO4-</b> Apply molecular modelling and structure activity relationship in drug designing</p> <p><b>CO5-</b> Summarize the role of drug receptors in neurotransmission, vaccine development and drug delivery system.</p> <p><b>CO6-</b> Compile information on drug designing based on molecular modeling and structure analysis.</p>
MMBE 303c	Molecular Virology and Infection	<p><b>CO1-</b> Learn about molecular basis of viral infection.</p> <p><b>CO2-</b> Discuss about history, cultivation, replication and virological method of viruses.</p> <p><b>CO3-</b> Write about viruses structure, replication, cultivation and antiviral agent.</p> <p><b>CO4-</b> Explain the viral infection, cultivation, antiviral agent and Virological Methods.</p> <p><b>CO5-</b> Summarize the steps of virus life cycle with reference to antiviral agent.</p> <p><b>CO6-</b> Compile the infection of viruses and Molecular diagnostic tools used in detection of viral infection.</p>
MMBC 304a	Environmental Microbiology	<p><b>CO1-</b> Define terminology used in Microbial Ecology, Air and Aquatic Microbiology, Microbial Interactions, Pollution and</p>

		<p>its Control, Impact of Microbes on Environment.</p> <p><b>CO2-</b> Explain and give examples where applicable related to ecosystem, ecosystem organization and microbial community, air borne transmission of microbes, aquatic microbiology, Positive and negative interactions amongst microbial populations, Interactions between microorganisms and plants , Interactions between microorganisms and animals, various pollution and its control and Impact of Microbes on Environment.</p> <p><b>CO3-</b> Write about the concept of ecosystem, ecosystem organization and microbial community, air borne transmission of microbes, aquatic microbiology, Positive and negative interactions amongst microbial populations, Interactions between microorganisms and plants , Interactions between microorganisms and animals, various pollution and its control and Impact of Microbes on Environment</p> <p><b>CO4-</b> Explain Microbial Ecology, Air and Aquatic Microbiology, Microbial Interactions, Pollution and its Control, Impact of Microbes on Environment</p> <p><b>CO5-</b> Summarize the study of Microbial Ecology, Air and Aquatic Microbiology, Microbial Interactions, Pollution and its Control, Impact of Microbes on Environment</p> <p><b>CO6-</b> Generalize the concept of Environmental Microbiology</p>
MMBC 304b	Agricultural Microbiology	<p><b>CO1-</b> Describe the role and affect of microorganism in agriculture.</p> <p><b>CO2-</b> Identify phytopathogens and apply the knowledge of their life cycle in prevention of plant diseases.</p> <p><b>CO3-</b> Apply the knowledge of rhizospheric bacteria in development of biofertilizers.</p> <p><b>CO4-</b> Summarize the mechanism of biocontrol utilized by biopesticides</p> <p><b>CO5-</b> Appreciate the diversity of microorganism and microbial communities inhabiting soil and affecting soil composition and causing plant diseases.</p> <p><b>CO6-</b> Compile information on plant microbes interactions like rhizosphere and mycorrhizae and their applications especially the biopesticides, biofertilizers and their production techniques.</p>
MMBC 304c	Ecosystem Analysis and Remote Sensing	<p><b>CO1-</b> Define Aerial Photography and Photogrammetry, Remote Sensing, Image Interpretation, Digital Image Processing and Geoinformatics.</p> <p><b>CO2-</b> Identify Fundamentals of Aerial Photography, Introduction of Remote Sensing and Image Interpretation, Image classification and Principle sand basics of Geographic Information System.</p> <p><b>CO3-</b> Apply the knowledge of Photogrammetry Geoinformatics., Remote Sensing, Image Interpretation, and Digital Image Processing.</p> <p><b>CO4-</b> Illustrate the method of Aerial Photography, Remote</p>

		<p>Sensing, Image Interpretation, Digital Image Processing and Geoinformatics.</p> <p><b>CO5-</b> Summarize the Principles of Aerial Photos and Remote Sensing, Digital Image Processing and Geoinformatics.</p> <p><b>CO6-</b> Justify the concept of Photogrammetry, Geoinformatics., Image Interpretation, Digital Image Processing.</p>
MMBC 304d	Mushroom Culture Technology	<p><b>CO1-</b> Define biology of mushrooms, Pests and disease of edible Mushroom, and Methods of storage of mushroom.</p> <p><b>CO2-</b> Identify the Methods of storage of mushroom. Nutritional value diseases and Marketing of mushrooms in India and world.</p> <p><b>CO3-</b> Apply the knowledge of Nutritional value and Marketing of mushrooms in India and world and knowledge about Pests and disease of edible Mushroom.</p> <p><b>CO4-</b> Illustrate the method of storage of mushroom, and also knowledge about of Nutritional value of diseases.</p> <p><b>CO5-</b> Summarize the Principles of Mushroom culture technology and Mushroom research centers/farms: National level and regional level.</p> <p><b>CO6-</b> Justify the concept of Photogrammetry, Geoinformatics., Image Interpretation, Digital Image Processing.</p>
MMBL305	Lab Course I	<p><b>CO1-</b> Identify and Memorize the Biosafety guidelines and biosafety levels.</p> <p><b>CO2-</b> Production, monitoring, Estimation of wine.</p> <p><b>CO3-</b> Determination the Isolation, biochemical characterization and antimicrobial susceptibility of pathogenic bacteria/fungi /clinical specimens.</p> <p><b>CO4-</b> Perform an experiment to determine MIC and MBC concentration of antibiotics by broth dilution method.</p> <p><b>CO5-</b> Estimate enzyme production by bacterial and fungal cultures.</p> <p><b>CO6-</b> Formulation of media for enzyme production by microbial cultures.</p>
MMBL 306	Lab Course II	<p><b>CO1-</b> Identification of food borne, environmental and soil borne diseases and detection of viral antigens in blood sample.</p> <p><b>CO2-</b> Interpretation of aerial photographs and data in GIS.</p> <p><b>CO3-</b> Assess quality of food, drugs and environmental samples.</p> <p><b>CO4-</b> Characterize bacteria isolated from soil, food and environment.</p> <p><b>CO5-</b> Evaluate production of lactic acid in sauerkraut.</p> <p><b>CO6-</b> Production of biofertilizers, mushroom and nano particles.</p>
MMBS 307a	Bioinformatics and Biological Techniques	<p><b>CO1-</b> Define Concepts, and scope of bioinformatics, data base of bioinformatics,</p> <p><b>CO2-</b> Identify the Methods of Principles of genome annotation, and Phylogenetics.</p> <p><b>CO3-</b> Apply the knowledge of bioinformatics, determination of protein structure, Microarray data analysis and</p>



		<p>Phylogenetics,</p> <p><b>CO4-</b> Illustrate the Bioinformatics data base, genome annotation, and Phylogenetics.</p> <p><b>CO5-</b> Summarize the Principles of computing in bioinformatic and Methods of Principles of genome annotation, and Phylogenetics.</p> <p><b>CO6-</b> Justify the concept of Microarray data analysis and Phylogenetics.</p>
MMBS 307b	Biomedical Technology	<p><b>CO1-</b> Define Cellular Pathology, Mutations and genetic disorders, Molecular diagnosis of infection.</p> <p><b>CO2-</b> Identify the Cellular Pathology, , Types and grading of cancer, Chemical mutagens and Molecular diagnosis of infection.</p> <p><b>CO3-</b> Apply the Immuno diagnostic tools in infection , Immunotherapy and chemotherapy of cancer cells. Single gene disorders, mutation and repair mechanism.</p> <p><b>CO4-</b> Illustrate the Immuno therapy and chemotherapy of cancer cells, Cellular Pathology, mutation and repair mechanism.</p> <p><b>CO5-</b> Summarize the Immunological basis of diseases, Gene therapy, Immuno therapy and chemotherapy of cancer cells.</p> <p><b>CO6-</b> Justify the Autoimmune disease, Mutations and genetic disorders and Cellular Pathology.</p>
MMBI308	Industrial Training Report/ Presentation	<p><b>CO1-</b> Observe innovative research to solve the problems faced in current scenario.</p> <p><b>CO2-</b> Observe and Recognize the basic concept of reading of review literatue/research paper.</p> <p><b>CO3-</b> Apply of adequate scientific understanding of the basic concepts in instrumentation used in research for both qualitative and quantitative analysis.</p> <p><b>CO4-</b> Analyze and carry out independent and collaborative research projects.</p> <p><b>CO5-</b> Choose a original research of significance and quality, for publications, presentations and original research proposals.</p> <p><b>CO6-</b> Formulate a small research proposal and published in research article.</p>
MMBE401	Dissertation	<p><b>CO1-</b> Observe a small research work in various field. To Accomplish organized conduct</p> <p><b>CO2-</b> Select and identify the methodology of project</p> <p><b>CO3-</b> Apply and Impart the outcome of their project in various seminars and conferences.</p> <p><b>CO4-</b> Apply and Present project work to a panel of experts.</p> <p><b>CO5-</b> Choose a Publish the research outcome in scientific peer reviewed journal.</p> <p><b>CO6-</b> Solve a research work by research methodology.</p>
MMBC402	Epidemiology	<p><b>CO1-</b> Describe the basic concept of epidemiology, disease transmission and control of epidemics.</p>

		<p><b>CO2-</b> Comprehend the scope and applications of epidemiology in study of disease transmission.</p> <p><b>CO3-</b> Analyze and interpret data on health surveillance</p> <p><b>CO4-</b> Analyze the pattern of disease spread and their control.</p> <p><b>CO5-</b> Recommend methods to prevent disease outbreaks by studying disease transmission dynamics and health surveillance according guidelines of public health organizations.</p> <p><b>CO6-</b> Hypothesize the cause and pattern of disease spread.</p>
MMBE403a	Beverage biotechnology	<p><b>CO1-</b> Identify and describe the Microorganism in food &amp; beverage industry, contamination and spoilage of different kinds of food and beverages, Biotechnology of food and feed, Food, Beverages &amp; Disease and food hygiene.</p> <p><b>CO2-</b> Discuss about microorganisms, contamination and spoilage of food and beverage industry, Biotechnology of food and feed, Bacterial food borne infection and intoxication, disease outbreak ,disease analysis and food hygiene and food control agencies.</p> <p><b>CO3-</b> Explain Microorganism in food &amp; beverage industry, contamination and spoilage of different kinds of food and beverages, Biotechnology of food and feed, Food, Beverages &amp; Disease and food hygiene</p> <p><b>CO4-</b> Explain and compare the role of Microorganisms in food &amp; beverage industry, contamination and spoilage, Bacterial food borne infection and intoxication and explain disease outbreak, disease analysis and food hygiene and food control agencies.</p> <p><b>CO5-</b> Summarize the Microorganisms, contamination and spoilage in food &amp; beverage industry, Bacterial food borne infection and intoxication, disease outbreak, disease analysis and food hygiene and food control agencies</p> <p><b>CO6-</b> Generalize the concept of beverage biotechnology.</p>
MMMBE 403b	Bio-Entrepreneurship	<p><b>CO1-</b> Define Starting a venture, accounting practices, Services Marketing, Human Resource Development and Role of knowledge centre and R&amp;D.</p> <p><b>CO2-</b> Explain Sources of financial assistance, accounting practices, Strategy with financiers, Entrepreneurship, Support mechanism for Entrepreneurship in India.</p> <p><b>CO3-</b> Illustrate accounting practices, source of financial assistance</p> <p><b>CO4-</b> Explain Human Resource Development, accounting practices, Support mechanism for Entrepreneurship.</p> <p><b>CO5-</b> Summarize the Support mechanism for Entrepreneurship in India. Role of Entrepreneurship in Microbiology Field.</p> <p><b>CO6-</b> Justify the knowledge about Services Marketing, Human Resource Development.</p>
MMBE 403c	Intellectual Property	<p><b>CO1-</b> Describe the basic aspects of IPR, patent and learn about various patent acts.</p>

	Rights	<p><b>CO2-</b> Comprehend the methods to protect intellectual ideas, designs, plant varieties etc.</p> <p><b>CO3-</b> Determine the role of various agencies in protection of intellectual property.</p> <p><b>CO4-</b> Analyze the applicability of various treaties in protection of intellectual property.</p> <p><b>CO5-</b> Appreciate the importance of patent, copyright, geographical indications and protection of plant varieties.</p> <p><b>CO6-</b> Justify the importance of IPR in current scenario.</p>
MMBL 404	Lab Course	<p><b>CO1-</b> Observe the pattern of spread of disease</p> <p><b>CO2-</b> Associate the disease pattern with transmission of causal organism.</p> <p><b>CO3-</b> Interpret the pattern of disease spread by</p> <p><b>CO4-</b> Analyze the pattern of disease outbreak.</p> <p><b>CO5-</b> Measurement of frequency and interpretation of combination based data</p> <p><b>CO6-</b> Calculation of morbidity, mortality and natality</p>
MMBJ 405	Journal Club	<p><b>CO1-</b> Read and awareness the student to recent research work related to Microbiology field.</p> <p><b>CO2-</b> Select a research paper to prepare assignment</p> <p><b>CO3-</b> Choose a research paper presentation as well as research project.</p> <p><b>CO4-</b> Analyze and Knowledge about publication rules and regulations.</p> <p><b>CO5-</b> Choose and Knowledge about screening of UGC Care Journals.</p> <p><b>CO6-</b> Formulate a protocol to carry on research work.</p>
MMBS 406a	Infection and Immunity	<p><b>CO1-</b> Define and memorize Infectious Agents, Immune Regulation of Infection, Immune Responses to Infection, Immunity against Bacterial, Viral and Prions Infections, Immunity against Fungal and Parasite Infections.</p> <p><b>CO2-</b> Discuss infection and its types, Infectious agents, pathogenicity etc., Immunological basis of infection; Immunity against Bacterial, Viral and Prions Infections, Immunity against Fungal and Parasite Infections.</p> <p><b>CO3-</b> Write and explain about the basic concepts of infection and immunity such as infection ,immunological basis of infection, immunity against various infection etc.</p> <p><b>CO4-</b> Explain about infection, types, infectious agents, immunogenicity of pathogens, Immunological basis of infection; Immunity against Bacterial, Viral and Prions Infections, Immunity against Fungal and Parasite Infections.</p> <p><b>CO5-</b> Summarize the idea of infection, infectious agents, Immune Responses to Infection, Immunity against Bacterial, Viral and Prions Infections, Immunity against Fungal and Parasite Infections.</p> <p><b>CO6-</b> Express the concept of infection and immunity</p>

MMBS 406 b	Research Methodology	<p><b>CO1-</b> Define research problem, review and asses the quality of literature from various sources.</p> <p><b>CO2-</b> Understand meaning, nature and scope of research in organizational behavior context.</p> <p><b>CO3-</b> Collect the data by various methods: observation, interview, questionnaires.</p> <p><b>CO4-</b> Analyze the link between quantitative research questions and data collection and how research questions are operationalized in educational practice.</p> <p><b>CO5-</b> Summarize the types of descriptive statistics typically reported in educational research studies</p> <p><b>CO6-</b> Structure the writing style used for quantitative and qualitative study.</p>
MMBS 406c	Tissue Biotechnology	<p><b>CO1-</b> Define research problem, review and asses the quality of literature from various sources.</p> <p><b>CO2-</b> Understand meaning, nature and scope of research in organizational behavior context.</p> <p><b>CO3-</b> Collect the data by various methods: observation, interview, questionnaires.</p> <p><b>CO4-</b> Analyze the link between quantitative research questions and data collection and how research questions are operationalized in educational practice.</p> <p><b>CO5-</b> Summarize the types of descriptive statistics typically reported in educational research studies</p> <p><b>CO6-</b> Structure the writing style used for quantitative and qualitative study.</p>

### MASTER OF SCIENCE (MATHEMATICS)

#### Program Outcome (PO)

<b>PO-1</b>	To cover the all main areas of Mathematics like Real Analysis, Functional Analysis, Measure Theory, Complex Analysis, Abstract Algebra, Topology, Differential equations, Integral equations, Calculus of variations, Differential Geometry, Mechanics, Fluid Dynamics, Operation research, Mathematical Statistics.
<b>PO-2</b>	The main motive of this Master's programme is deep understanding in the fundamental mathematics (graduate Mathematics) and lead to the advanced Mathematics and research oriented things.
<b>PO-3</b>	Students able to understand the route in between the different areas of Mathematics and understand the connectivity in subjects
<b>PO-4</b>	Students able to design the Mathematical model for different type of problems in Physical science and in Engineering like as Mechanical, Civil, Chemical etc.
<b>PO-5</b>	Can help to solve the problems based on Industrial mathematics.
<b>PO-6</b>	Can help to solve the problems based on space science.
<b>PO-7</b>	Able to apply the mathematical reasoning to solve the subjective /objective problems and research ideas
<b>PO-8</b>	The skills and knowledge gained in this program will be helpful for modelling and solving of real life problems in scientific manner.
<b>PO-9</b>	Students are motivate and prepare for research studies in mathematics and related fields.
<b>PO-10</b>	Should be able to apply their skills and knowledge in various fields of studies including, science, engineering, commerce and management.
<b>PO-11</b>	Able to develop the competitive skills to clear the National level exams like as NET, GATE DRDO exam for scientific post etc.
<b>PO-12</b>	Have sound knowledge of mathematical modelling, and computational techniques as required for employment in industry in various government and private sector.

### M.SC. MATHEMATICS

#### Program Specific Outcome (PSO)

<b>PSO-1</b>	Have a strong foundation in core areas of Mathematics, both pure and applied.
<b>PSO-2</b>	Student should be able to think in a critical manner and develop problem solving skills.
<b>PSO-3</b>	Communicate mathematical ideas effectively, in writing as well as orally
<b>PSO-4</b>	Able to formulate and develop mathematical arguments in a logical manner.

#### Course Outcome (CO)

Course Code	Course Name	Outcome
MMTC101	DIFFERENTIAL EQUATIONS	<p><b>CO1-</b> Remembering elementary terms like as Wronskian, Ordinary points, Regular and singular points of ODE etc.</p> <p><b>CO2-</b> Understand the Frobenius series solution for Legendre's and Bessel's differential equations with generating functions etc.</p> <p><b>CO3-</b> Classification of PDE of 2nd order and canonical forms, Concept of separation of variable solution.</p> <p><b>CO4-</b> Analysis the theory of ordinary differential equations through applications, methods of solution and numerical</p>

		<p>approximations.</p> <p><b>CO5-</b> Determine what function or functions satisfy the equation.</p> <p><b>CO6-</b> Develop new solutions related to PDE and ODE.</p>
MMTC102	ABSTRACT ALGEBRA- I	<p><b>CO1-</b> Define all aspects of Abstract Algebra.</p> <p><b>CO2-</b> Explain Homomorphism, Endomorphism, Automorphism, Inner automorphism, Kernel of a homomorphism, Fundamental theorem on homomorphism of group, Group of automorphisms , Results on group homomorphism. Maximal subgroups, Ideals, Algebra of ideals, Principal ideal ring.</p> <p><b>CO3-</b> Use algebraic methods to solve a variety of problems involving exponential, logarithmic, polynomial, and rational functions, systems of equations and inequalities, sequences</p> <p><b>CO4-</b> Analyze a given algebraic structure in detail.</p> <p><b>CO5-</b> Criticize the study of certain structures called groups, rings, fields and some related structures.</p> <p><b>CO6-</b> Investigate Algebraic structure by correctly completing several logical steps before arriving at a final answer.</p>
MMTC103	MECHANICS	<p><b>CO1-</b> Memorize the understanding of Classical Mechanics using Lagrangian and Hamiltonian Approach</p> <p><b>CO2-</b> Describe the reduction of a two-body problem to a one-body problem in a central force system</p> <p><b>CO3-</b> Explain the theory of relativity for particles having relativistic speeds.</p> <p><b>CO4-</b> Determine the various Four vectors: position, velocity, acceleration, momentum, Force etc.</p> <p><b>CO5-</b> Compare Lagrangian and Hamiltonian formalism, Galilean and Lorentz transformation and various reference frames.</p> <p><b>CO6-</b> Apply theory of relativity to determine time dilation, length contraction and simultaneity,</p>
MMTC104	COMPLEX ANALYSIS	<p><b>CO1-</b> Recall the basic definitions of analytic function, of Zeros and poles and Singularities. Understand about the kind of singularities of meromorphic functions which helps in residue theory and contour integrations.</p> <p><b>CO2-</b> Describe conformal mappings between various plane regions.</p> <p><b>CO3-</b> Explain the central ideas in the solution of Taylor and Laurent series.</p> <p><b>CO4-</b> Classify curves and regions in the complex plane defined by simple expressions.</p> <p><b>CO5-</b> <b>Decide when and where a given function is analytic and be able to find it series development.</b></p> <p><b>CO6-</b> Produce and create the analytic functions and concerned results.</p>

MMTC105	OPERATIONS RESEARCH- I	<p><b>CO1-</b> Define and identify the different concept based problems of Operational Research.</p> <p><b>CO2-</b> Explain and show the results based on problems of Operational Research</p> <p><b>CO3-</b> Solve , Calculate and construct the different problems of Operational Research</p> <p><b>CO4-</b> Analyze different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.</p> <p><b>CO5-</b> Measure any real life system with limited constraints and depict it in a model form.</p> <p><b>CO6-</b> Express the all theories of OR and solve the related problem</p>
MMTC201	ABSTRACT ALGEBRA- II	<p><b>CO1-</b> Define all aspects of advanced Abstract Algebra.</p> <p><b>CO2-</b> Explain the different algebraic structures of advanced Abstract Algebra.</p> <p><b>CO3-</b> Solve the related problems embedding ring, field extension and module and Galois group</p> <p><b>CO4-</b> Analyze a given structure in detail and categorize.</p> <p><b>CO5-</b> Criticize the study of certain structures called Embedding of rings, Euclidean ring, Module, Extension fields Galois group and some related structures and evaluate the related problems.</p> <p><b>CO6-</b> Develop and design the Algebraic structure by correctly completing several logical steps before arriving at a final answer.</p>
MMTC202	DISCRETE STRUCTURES	<p><b>CO1-</b> Identify the basic definitions in discrete structures and related examples.</p> <p><b>CO2-</b> Explain conceptual based problems of discrete structures and their solutions.</p> <p><b>CO3-</b> Solve the problems of Boolean algebra, Boolean functions, canonical forms of Boolean expressions and solve Karnaugh-Maps.</p> <p><b>CO4-</b> Analyze the Application of Boolean algebra to switching theory and classify the problems of Graphs</p> <p><b>CO5-</b> Evaluate Recurrence relations, Directed graphs, Undirected graphs, Eulerian and Hamiltonian graphs, Planner graphs, Connected graphs and related theorems.</p> <p><b>CO6-</b> Design and formulate the problems on discrete structures</p>
MMTC203	OPERATIONS RESEARCH- II	<p><b>CO1-</b> Identify the concept based problems related to advanced OR</p> <p><b>CO2-</b> Understand the different model of OR and how to solve their problems.</p> <p><b>CO3-</b> Solve the EOQ models, queuing models –problems and other related problems of OR,</p> <p><b>CO4-</b> Analyze EOQ models, queuing theory Markov chain</p>



		<p>and its application and dynamic programming and quadratic programming.</p> <p><b>CO5-</b> Evaluate sequencing problems, processing <math>n</math> jobs through two and three machines and other related to advanced OR.</p> <p><b>CO6-</b> Design and construct the solution of problems based queuing models, Markov chain, dynamic programming and quadratic programming.</p>
MMTC204	REAL ANALYSIS	<p><b>CO1-</b> Define and identify the basic of sequences and series of functions, function of several variables.</p> <p><b>CO2-</b> Understand How to check the pointwise/uniform convergence of the sequences/series of functions for the different cases and explain the Riemann-Stieltjes Integral, function of several variables.</p> <p><b>CO3-</b> Explain and describe the results based on sequences and series of functions, power series, function of several variables Weierstrass approximation theorem and how to apply these results in the problems.</p> <p><b>CO4-</b> Analyze the different theoretical problems in real analysis</p> <p><b>CO5-</b> Evaluate and the justify the problems in The Riemann-Stieltjes Integral, sequences and series of functions, function of several variables.</p> <p><b>CO6-</b> Develop and express the problems related to function of several variables, sequences and series of functions, the inverse function theorem, and implicit function theorem.</p>
MMTC205	TOPOLOGY-I	<p><b>CO1-</b> Identify the basic of the different kind of metric spaces and problems</p> <p><b>CO2-</b> Understand the concept of nbd and its related, Homeomorphism, Connectedness, completeness, Complete metric spaces and solve the related problems.</p> <p><b>CO3-</b> Solve the problems based on concept of map in between metric spaces like Homeomorphism (1-1, onto, open/closed, continuous), Uniform continuity &amp; Isometry and all others related to metric spaces</p> <p><b>CO4-</b> Analyze the Bolzano-Weierstrass property, sequentially compact and compact; prove the Lebesgue covering lemma and others problems related to metric spaces</p> <p><b>CO5-</b> Evaluate the problems on sequences and Cauchy sequences in metric spaces how it will be Complete metric spaces. Cantor's intersection theorem, Baire Category theorem, and Banach's fixed point theorem (based on contraction mapping). Justify the answer related to completeness of metric spaces and prove the completeness of the following: real line, unitary space, Euclidean space and other problems of metric spaces</p> <p><b>CO6-</b> Make the solution of theoretical numerical problems of Connectedness in metric spaces, and others problems</p>

		related to metric spaces
MMTC301	TOPOLOGY- II	<p><b>CO1-</b> Identify the basic problems of general topology and its sub topics for example 1, How to determine interior, Exterior and accumulation points closure, boundary, and basis and sub basis of topological spaces. 2 check whether a collection of subsets is a basis for a given topological spaces or not, and determine the topology generated by a given basis. Same as for other topics of this course</p> <p><b>CO2-</b> Explain the continuous maps between two spaces and maps from a space into product space and determine common topological property of given two spaces. Determine the connectedness and path connectedness of the product of an arbitrary family of spaces. Understand the all other things related to this course</p> <p><b>CO3-</b> <b>Solve</b> the Hausdorff spaces problems using the concept of net in topological spaces and learn about 1st and 2nd countable spaces, separable and prove the Lindelöf theorem. Compactness and connectedness. And determine other problems related to this course</p> <p><b>CO4-</b> <b>Analyze and test</b> the problems of Compactness, connectedness and <math>T_0</math>, <math>T_1</math>, <math>T_2</math>, <math>T_3</math>, <math>T_4</math> spaces and all others related problems of topological spaces</p> <p><b>CO5-</b> Test and justify the solutions of problems based on topological spaces.</p> <p><b>CO6-</b> Prepare and express the all major theorems of this course.</p>
MMTC302	FUNCTIONAL ANALYSIS	<p><b>CO1-</b> Identify the basic of Normed spaces and verify the requirements of a norm, completeness with respect to a norm, relation between compactness and dimension of a space. Define the Banach spaces, Subspaces, Quotient Spaces, and Hilbert spaces and their related problems.</p> <p><b>CO2-</b> Explain the boundedness of a linear operator and relate to continuity, convergence of operators by using a suitable norm, compute the dual spaces. extend a linear functional under suitable conditions, compute adjoint of operators, check reflexivity of a space, ability to apply/prove uniform boundedness theorem, open mapping theorem and closed graph theorem, Hahn-Banach theorem check the convergence of operators and functional and weak and strong convergence of sequences.</p> <p><b>CO3-</b> Explain the little theorems on Normed spaces, Banach spaces, Subspaces, Quotient Spaces, Inner product spaces, Hilbert spaces, Orthogonality of vectors, Orthogonal Complements and, Orthonormal Sets. distinguish between Banach spaces and Hilbert spaces, decompose a Hilbert space in terms of orthogonal complements, check totality of orthonormal sets and</p>

		<p>sequences, represent a bounded linear functional in terms of inner product,</p> <p><b>CO4-</b> Analyze problems of Banach spaces, Subspaces, Quotient Spaces, and Hilbert spaces Operators on Hilbert Spaces and their related problems.</p> <p><b>CO5-</b> Test Banach spaces, Subspaces, Quotient Spaces, and Hilbert spaces Operators on Hilbert Spaces and their related problems. ability to apply/prove projection theorem, Riesz representation theorem</p> <p><b>CO6-</b> Make a solutions of problems related to Banach spaces, Subspaces, Quotient Spaces, and Hilbert spaces Operators on Hilbert Spaces and other related problems</p>
MMTE303	CALCULUS OF VARIATIONS	<p><b>CO1-</b> Identify the basic problems on the different types of Variational problems like as problem in which functional depends on first order derivatives, several dependent variables first order partial derivatives, based on parametric form, isoperimetric problems. Ritz, Galerkin, Collocation and Kantrovitch methods etc.</p> <p><b>CO2-</b> Explain the theoretical problems of variational calculus.</p> <p><b>CO3-</b> Solve the all major kind of problems of variational calculus e.g. the General variational of functional, Variable end point problems, Transversality condition and transversal theorem, Weierstrass-Endmann corner condition and all other related to this course.</p> <p><b>CO4-</b> Analyze the theoretical problems of variational calculus like as Sufficient condition for extremum: second variation, Legendre's and Jacobi's necessary condition, Weierstrass function, Canonical transformation, Noether's theorem etc.</p> <p><b>CO5-</b> Evaluate the all major and minor problems of calculus of variation and on application of variational calculus like as The principle of least action, Conservation law, Hamilton Jacobi's equations, and solve the related problems.</p> <p><b>CO6-</b> Make the solutions and proofs of different types of Variational problems like as Transform ODE and PDE into functionals and solve by Ritz, Galerkin, Collocation and Kantrovitch methods etc.</p>
MMTE304	MATHEMATICAL STATISTICS	<p><b>CO1-</b> Identify the basic problems on the different types of Discrete probability, Baye's theorem, Random variables and distribution functions, Mathematical expectations and moments t, z and chi square test, Correlation, Rank correlation, Regression and solve the related problems.</p> <p><b>CO2-</b> Understand theoretical problems of the Discrete probability, Random variables and distribution functions, Mathematical expectations and moments, probability distributions, t, z and chi square test, Correlation, Regression and solve the related problems.</p> <p><b>CO3-</b> Solve the Correlation, Regression and all related</p>

		<p>problems to the course</p> <p><b>CO4-</b> Analyze the Multiple and partial correlation of three variables only, Data reduction techniques, Canonical correlation and all related problems to the course</p> <p><b>CO5-</b> Evaluate the problems on the different types of Discrete probability , probability distributions, sampling, Correlation, Regression and all other topics.</p> <p><b>CO6-</b> Develop the technique to test of hypothesis and how to solve the problem based on t, z and chi square test and all other topics</p>
MMTE305	DIFFERENTIAL GEOMETRY	<p><b>CO1-</b> Identify the basic concepts based problems of Curves in space, surface, surfaces of revolution, minimal surfaces and recall all other concepts of fundamental differential geometry.</p> <p><b>CO2-</b> Understand comfortably familiar with Concept of a surface, Envelope and developable surface, Parametric curves, Family of the surfaces, Edge of regression, Ruled surfaces, Central points. and about linear self-adjoint Weingarten map and curvature of a plane curve with applications in geometry and physics, and the all major and minor problems of differential Geometry</p> <p><b>CO3-</b> Solve the numerical problems of Fundamental forms and curvature of surfaces, First fundamental form and Second fundamental form of the surfaces of revolution, surfaces with boundary and be able to solve various problems and the Gauss-Bonnet theorem and all other related to this course</p> <p><b>CO4-</b> Analyze the major and minor problems of differential Geometry e.g. Curves in space, the basic properties of a surface Normal curvature, Principal directions, Principal curvatures, minimal surfaces, Rodrigues and Monge's theorem, Euler's theorem, Joachimisthal's theorem, Dupin's indicatrix, Third fundamental form</p> <p><b>CO5-</b> Evaluate the major and minor problems of differential Geometry</p> <p><b>CO6-</b> Develop solution/proof of problems of differential Geometry</p>
MMTE306	Algebraic Geometry	<p><b>CO1-</b> Identify the all types of basic concepts based problems of Algebraic Geometry</p> <p><b>CO2-</b> Understand the theoretical concepts based problems of varieties, and prove the Noether Normalization Theorem, Riemann-Roch theorem and all related topics.</p> <p><b>CO3-</b> Solve the numerical problems of local properties of algebraic curve, the Riemann-Roch theorem for curves, Affine algebraic varieties etc.</p> <p><b>CO4-</b> Analyze the problems of algebraic sets, varieties Rational mappings and bi-rational geometry and Riemann-Roch theorem for curves etc.</p>

		<p><b>CO5-</b> Evaluate the major and minor problems of Algebraic Geometry</p> <p><b>CO6-</b> Develop the solution/proof of problems of Algebraic Geometry</p>
MMTE307	ALGEBRAIC CODING THEORY	<p><b>CO1-</b> Identify the all types of conceptual problems of communication channel, The coding problem, Types of codes, Error detecting and error-correcting codes, Linear codes, Hamming metric, Description of linear block codes by matrices and all other related to Algebraic Coding Theory.</p> <p><b>CO2-</b> Understand Dual codes, Standard array, Step-by-step decoding, Modular representation, Error-correction, Capabilities of linear codes, Bounds of minimum distance for block codes, Plotkin bound, Hamming sphere packing bound, Bounds for burst-error detecting and correcting codes and all other related to Algebraic Coding Theory.</p> <p><b>CO3-</b> Solve the Important linear block codes, Hamming codes, Golaycodes, Perfect codes, Quasiperfect codes, Reed-Muller codes, Codes derived from Hadamard matrices, Product codes, Concatenated codes. and all other related to Algebraic Coding Theory</p> <p><b>CO4-</b> Analyze the little problems/results A double error correcting decimal code and an introduction to BCH codes, BCH bounds, Cyclic codes, understand Matrix representation of cyclic codes, Error detection and cyclic codes, MDS codes and all other related to Algebraic Coding Theory.</p> <p><b>CO5-</b> Evaluate the major and minor problems of Algebraic Coding Theory</p> <p><b>CO6-</b> Develop the solution/proof of problems of Algebraic Coding Theory</p>
MMTE308	Theory of Elasticity	<p><b>CO1-</b> Define and identify the conceptual problems of Theory of Elasticity</p> <p><b>CO2-</b> Understand the theoretical problems of Cartesian tensor, Analysis of stress, strain, and deformation and all other problems of this course</p> <p><b>CO3-</b> Solve the numerical problems of Cartesian tensor, Analysis of stress, strain, and deformation and all other problems of this course</p> <p><b>CO4-</b> Analyze the solution of problems of Cartesian tensor, Analysis of stress, strain, and deformation and all other problems of Theory of Elasticity</p> <p><b>CO5-</b> Evaluate the major and minor problems of Theory of Elasticity</p> <p><b>CO6-</b> Develop the solution/proof of problems of Theory of Elasticity</p>
MMTS309	COMPUTER	<p><b>CO1-</b> Identify conceptual problems on the Fundamentals of</p>

	FUNDAMENTALS AND DATA STRUCTURES	<p>computer system like as Sorting, Searching, Algorithms and graphs and all other related to course</p> <p><b>CO2-</b> Understand the theoretical problems related to computer fundamentals and data</p> <p><b>CO3-</b> Solve the computational problems of based on of Truth tables, Boolean algebra, De-Morgan's theorem, Logical gates, Logic diagram, Logical expressions/functions, Karnaugh maps, Searching, Algorithms and graphs etc</p> <p><b>CO4-</b> Analyze the Fundamentals of computer system like as Sorting, Searching, Algorithms and graphs and all other related to course</p> <p><b>CO5-</b> Evaluate the major and minor problems of computer fundamentals and data structures</p> <p><b>CO6-</b> Develop the solution/proof of problems of computer fundamentals and data structures</p>
MMTS310	MATHEMATICAL METHODS	<p><b>CO1-</b> Identify the all types of the basic of basic of Laplace and integral transform and some application to solve ODE and PDE and Hermite polynomial, Chebyshev polynomial, Laguerre polynomial</p> <p><b>CO2-</b> Understand the theoretical problems related to Hermite polynomial, Chebyshev polynomial, Laguerre polynomial, Integral transforms</p> <p><b>CO3-</b> Solve the numerical problems related to the basic of Laguerre differential equation, Chebyshev polynomial, Hermite polynomial and all others related to this course.</p> <p><b>CO4-</b> Analyze to integral transform and its various types know the basic of Laplace and integral transform and some application to solve ODE and PDE and Hermite polynomial, Chebyshev polynomial, Laguerre polynomial</p> <p><b>CO5-</b> Evaluate the major and minor problems related to Hermite polynomial, Chebyshev polynomial, Laguerre polynomial, Integral transforms</p> <p><b>CO6-</b> Develop the solution/proof of problems related to Hermite polynomial, Chebyshev polynomial, Laguerre polynomial, Integral transforms</p>
MMTC401	MEASURE AND INTEGRATION	<p><b>CO1-</b> Identify the all types of conceptual problems Measurable sets, measurable functions, Lebesgue integral, functions of bounded variations etc.</p> <p><b>CO2-</b> Understand the requirement and the concept of the Measurable sets, measurable functions, Lebesgue integral, Differentiation of an integral along its properties.</p> <p><b>CO3-</b> Solve the problems of the measure theory and integration.</p> <p><b>CO4-</b> Analyze the concepts of functions of bounded variations and the absolute continuity of functions with their relations, concept of</p>

		<p>the Measurable sets , measurable functions, Lebesgue integral, Differentiation of an integral along its properties.</p> <p><b>CO5-</b> Evaluate the all major and minor problems of this course.</p> <p><b>CO6-</b> Develop the sol/proof of all major and minor problems/theorems of this course</p>
MMTC402	FLUID DYNAMICS	<p><b>CO1-</b> Identify the concepts based problems of fluid dynamics</p> <p><b>CO2-</b> Understand the concepts based problems of fluid dynamics</p> <p><b>CO3-</b> Solve the different kind of numerical problems of fluid dynamics like as obtain solution for non-viscous flow problem and all others</p> <p><b>CO4-</b> Analyze the different kind of problems of fluid dynamics</p> <p><b>CO5-</b> Evaluate the related problems to Kinematics of fluids, Flow and circulation, non-viscous flow, Motion in two dimensions, Stream function, Complex potential, Source, Sink, Doublet and all related to this course</p> <p><b>CO6-</b> Develop the sol/proof of all major and minor problems/theorems of this course</p>
MMTE403	LINEAR INTEGRAL EQUATIONS	<p><b>CO1-</b> Define basic of integral equation, and Relation between differential and integral Equations, Volterra integral equations, Fredholm integral equations, Abel integral equation and all other related topics</p> <p><b>CO2-</b> Understand the problems based on Eigen values and Eigen functions of Fredholm equations of second kind with Separable kernels. Determine the resolvent kernel and solution of Volterra integral equations with the help of resolvent kernel. Understand the basic of Integral equations with symmetric kernel, fundamental properties of Eigen values and Eigen functions symmetric kernel, Singular integral equations</p> <p><b>CO3-</b> Solve the problems Method of successive approximation for Fredholm and Volterra equations of the second kind, Singular integral equations , Integral equation with Green's function type kernels etc</p> <p><b>CO4-</b> Analyze the basic of Volterra integral equations, Fredholm integral equations, Abel integral equation and all other related topics of linear integral equations</p> <p><b>CO5-</b> Evaluate and test the all problems of integral equations</p> <p><b>CO6-</b> Develop the sol/proof of all problems/results of this course.</p>
MMTE404	NUMBER THEORY	<p><b>CO1-</b> Define and identify problems on Number Theory like as the theory of congruences, how to solve problems related to Linear congruence and Chinese remainder theorem, Continued fraction, Number theoretic function, Fermat's theorem, Wilson's theorem and Euler theorem,</p>



		<p>Primes Numbers etc</p> <p><b>CO2-</b> Understand the theoretical problems of Number Theory like as the theory of congruences, how to solve problems related to Linear congruence and Chinese remainder theorem, Continued fraction, Number theoretic function, Fermat's theorem, Wilson's theorem and Euler theorem, Primes Numbers, Binary and decimal representation of integers etc</p> <p><b>CO3-</b> Solve the various type of problems based on Number theoretic function, theory of congruences, how to solve problems related to Continued fraction, Fermat's theorem, Wilson's theorem and Euler theorem, Primes Numbers etc</p> <p><b>CO4-</b> Prove the Fermat's theorem, Wilson's theorem and Euler theorem.</p> <p><b>CO5-</b> Evaluate and test the problems and results of Number Theory</p> <p><b>CO6-</b> Develop the sol/proof of all problems/results of this course.</p>
MMTE405	FUZZY SET THEORY	<p><b>CO1-</b> Define and Identify the basic of Fuzzy sets theory.</p> <p><b>CO2-</b> Understand the theoretical problems of Fuzzy sets theory like as extension principle and The Zadeh's extension principle, Images and inverse image of fuzzy sets, Fuzzy logic etc</p> <p><b>CO3-</b> Solve the numerical/ theoretical problems of Fuzzy sets theory like as extension principle and The Zadeh's extension principle, Images and inverse image of fuzzy sets, Fuzzy logic Fuzzy numbers, Element of fuzzy arithmetic etc</p> <p><b>CO4-</b> Analyze Fuzzy relation and fuzzy graphs, Fuzzy relation on fuzzy sets, composition of fuzzy relation, min-max composition and properties, equivalence relations, fuzzy compatibility relation, Fuzzy relation equations.</p> <p><b>CO5-</b> Evaluate the problems related to Fuzzy logic, Fuzzy propositions, Fuzzy qualifiers, Linguistic variables and hedge, extension principle and The Zadeh's extension principle, Images and inverse image of fuzzy sets, Fuzzy logic Fuzzy numbers, Element of fuzzy arithmetic etc</p> <p><b>CO6-</b> Develop the sol/proof of all problems/results of Fuzzy sets Theory.</p>
MMTE406	Fourier Analysis	<p><b>CO1-</b> Define the problems of Fourier Analysis</p> <p><b>CO2-</b> Understand the Inversion formula and the Parseval identity. Paley Wiener's theorem, Tauberian theorem, Dirichlet problem., Classical Hardy spaces F and M. Reisz theorem etc.</p> <p><b>CO3-</b> Solve the problems of Fourier Analysis like as Fourier</p>

		<p>transforms, the Schwartz space, Plancherel formula, Maximal function and distributions, Tempered distribution,, Fourier analysis and filters. Bessel functions.</p> <p><b>C04-</b> Analyze the problems of Fourier Analysis</p> <p><b>C05-</b> Evaluate and test problems of Fourier Analysis</p> <p><b>C06-</b> Develop the solution and proof of problems/results of Fourier Analysis</p>
MMTE407	FLUID MECHANICS	<p><b>C01-</b> Define the basic problems of Fluid Mechanics</p> <p><b>C02-</b> Understand problems of Fluid Mechanics</p> <p><b>C03-</b> Solve the problems of Fluid Mechanics</p> <p><b>C04-</b> Analyze the problems of Fluid Mechanics</p> <p><b>C05-</b> Evaluate and test problems of Fluid Mechanics</p> <p><b>C06-</b> Develop the solution and proof of problems/results of Fluid Mechanics</p>
MMTS409	MATHEMATICAL MODELING	<p><b>C01-</b> Define and identify the idea of Mathematical modelling in so many areas of science and technology</p> <p><b>C02-</b> Understand the Mathematical Modeling through systems of ordinary differential equations of first order, and how to apply in Population dynamics, Epidemics-compartment models, Economics, Medicine, Arm- race, Battles and international trade- dynamics.</p> <p><b>C03-</b> Solve Use Mathematical modeling through ordinary differential equations of second order in Planetary motions, Circular motion, Motion of satellites,</p> <p><b>C04-</b> Analyze Mathematical modeling problems</p> <p><b>C05-</b> Evaluate the problems of mathematical modeling</p> <p><b>C06-</b> Develop the solution/proof of different types of major and minor problems/results based on mathematical modeling</p>
MMTS410	SPECIAL THEORY OF RELATIVITY	<p><b>C01-</b> Define and identify significance of the postulate of Special Relativity and basic problems of this course.</p> <p><b>C02-</b> Understand and Explain the ether theory, how it relate to Relativity, twin paradox, Lorentz transformation, Maxwell's equations and all related problems.</p> <p><b>C03-</b> Solve the concepts based problems of length contraction and time dilation and what is Longitudinal Contraction, Lorentz transformation, Maxwell's equations and all related problems.</p> <p><b>C04-</b> Analyze the Maxwell's equations and use their relativistic invariance Understand the Galilean transformation and how to apply the Lorentz transformation in special relativity the Invariant Interval, Proper time and proper distance, World line etc.</p> <p><b>C05-</b> Test the different types of mathematical problems based on Special theory of relativity like as the twin paradox, Relativistic Doppler's effect, Lorentz transformation,</p>

		Maxwell's equations and all related problems. <b>CO6-</b> Design and create solution of the problems of this course
MMTS411	Mathematics for Finance and Insurance	<b>CO1-</b> Define and identify the basic problems of Finance and Insurance. <b>CO2-</b> Understand the numerical problems Finance and Insurance <b>CO3-</b> Solve the numerical/ theoretical problems based on Finance and Insurance, like as Develop ability to understand, analyze and solve problems in bonds, finance and insurance, Build skills for computation of premium of life insurance etc . <b>CO4-</b> Analyze the Build skills for computation of premium of life insurance and claims for general insurance using probability distributions and all other problems related to this course. <b>CO5-</b> Test the different types of mathematical problems based on Finance and Insurance <b>CO6-</b> Design and create solution of the problems of this course

## MASTER OF SCIENCE (BIOTECHNOLOGY)

### Program Outcome (PO)

PO-1	Acquire knowledge and enhance their fundamentals pertaining to basic and applied fields of biotechnology and allied sciences including microbiology, computer application, biostatistics etc.
PO-2	Exhibit technical skills to apply modern tools, techniques (bio-analytical, IT, biostatistics) and identify the utility and application in scientific studies.
PO-3	Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
PO-4	Exhibit ability to design and conduct laboratory-based experiments and inculcate research aptitude and critical thinking ability to analyze and interpret data.
PO-5	To identify entrepreneurship potential of biotechnological process and products, impact on environment and society, along with associated ethical issues.
PO-6	Enhance their presentation, communication and writing skills through trainings, seminars, research writing, report writing.
PO-7	Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO-8	Demonstrate an ability to identify the potential of biotechnology (basic and applied) to recognize and propose/ design/derive a solution to complex problem. Attain eligibility and competency pursue career in research, various industries, entrepreneurship and inculcate lifelong learning ability.
PO-9	Effective Writing: Got Skill for Write up in scientific literature and other social media platform related to life science.
PO-10	Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
PO-11	Social Interaction and Ethics: Elicit views of others, mediate disagreements and help reach conclusions in group. Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them settings conclusions in group settings.
PO-12	Interdisciplinary approach and Practical learning: Analyse the relationships among animals, plants, microbes and Industry. Perform procedures as per laboratory standards in the areas of Biochemistry, Bioinformatics, Genomics, industrial biotechnology and fermentation technology.

## M. Sc. BIOTECHNOLOGY

### Program Specific Outcome (PSO)

PSO-1	Demonstrate proficiency in theoretical as well as practical knowledge in the field of biotechnology and allied sciences (molecular & cell biology, biochemistry, bioinformatics, RDT, plant & animal science environmental biotechnology, immunology, IPR, Genomics, microbiology, Computer application, biostatistics & others).
PSO-2	Exhibit potential to design and conduct experiments, analyze and interpret data in different field of biotechnology along with inculcation of research-oriented learning.
PSO-3	Identify the potential and application of biotechnology and scientific knowledge to design / derive a solution of problem pertaining to environment conservation, health, agriculture, society and industry considering associated ethical issues.
PSO-4	Ability to analyze prevailing career opportunities to pursue a career in research, industries, other organizations, setup start-ups.

**Course Outcome (CO)**

Course Code	Course Name	Outcome
MBTC-101	Cell Biology, Developmental Biology, Biophysics	<p><b>CO1- Remember</b> the basic concepts of general character of Cell Biology, Developmental Biology, Biophysics: Plasma membrane, intracellular compartments, cell movements, Vesicular trafficking and signal transduction, Cell cycle, Molecular events and regulation, cancer, Developmental Biology and physical processes in biology.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts and applications of Cell Biology, Developmental Biology, Biophysics: Plasma membrane, intracellular compartments, cell movements, Vesicular trafficking and signal transduction, Cell cycle, Molecular events and regulation, cancer, Developmental Biology and physical processes in biology including Principle of measurement. Applications of ultrasound in medical diagnostics. X-rays, their properties.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of Cell Biology, Developmental Biology, Biophysics: Plasma membrane, intracellular compartments, cell movements, Vesicular trafficking and signal transduction, Cell cycle, Molecular events and regulation, cancer, Developmental Biology and physical processes in biology including Principle of measurement. Applications of ultrasound in medical diagnostics. X-rays, their properties.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to Cell Biology, Developmental Biology, Biophysics: Plasma membrane, intracellular compartments, cell movements, Vesicular trafficking and signal transduction, Cell cycle, Molecular events and regulation, cancer, Developmental Biology and physical processes in biology including Principle of measurement. Applications of ultrasound in medical diagnostics. X-rays, their properties.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the Cell Biology, Developmental Biology, Biophysics: Plasma membrane, intracellular compartments, cell movements, Vesicular trafficking and signal transduction, Cell cycle, Molecular events and</p>

		<p>regulation, cancer, Developmental Biology and physical processes in biology including Principle of measurement. Applications of ultrasound in medical diagnostics. X-rays, their properties.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Cell Biology, Developmental Biology, Biophysics: Plasma membrane, intracellular compartments, cell movements, Vesicular trafficking and signal transduction, Cell cycle, Molecular events and regulation, cancer, Developmental Biology and physical processes in biology including Principle of measurement. Applications of ultrasound in medical diagnostics. X-rays, their properties.</p>
MBTC-102	Biological & Radiotracer Techniques	<p><b>CO1- Remember</b> the basic concepts of general character of Biological &amp; Radiotracer Techniques: Analytical separation: chromatography, electrophoresis, centrifugation, principles and applications of microscopy, Spectroscopic methods and Safety rules in handling of radioisotopes and hazardous chemicals.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts and applications of Biological &amp; Radiotracer Techniques: Analytical separation: chromatography, electrophoresis, centrifugation, principles and applications of microscopy, Spectroscopic methods and Safety rules in handling of radioisotopes and hazardous chemicals.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of Biological &amp; Radiotracer Techniques: Analytical separation: chromatography, electrophoresis, centrifugation, principles and applications of microscopy, Spectroscopic methods and Safety rules in handling of radioisotopes and hazardous chemicals.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to Biological &amp; Radiotracer Techniques: Analytical separation: chromatography, electrophoresis, centrifugation, principles and applications of microscopy, Spectroscopic methods and Safety rules in handling of radioisotopes and hazardous chemicals.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the Biological &amp; Radiotracer Techniques: Analytical separation: chromatography, electrophoresis, centrifugation,</p>

		<p>principles and applications of microscopy, Spectroscopic methods and Safety rules in handling of radioisotopes and hazardous chemicals.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Biological &amp; Radiotracer Techniques: Analytical separation: chromatography, electrophoresis, centrifugation, principles and applications of microscopy, Spectroscopic methods and Safety rules in handling of radioisotopes and hazardous chemicals.</p>
MBTC-103	Molecular Biology & Genetics	<p><b>CO1- Remember</b> the different basic concepts of introduction to molecular biology and genetics: DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation, concept of genetic code, Mendelism's and cocept of chromosomal aberrations.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation. concept of genetic code, Mendelism's and cocept of chromosomal aberrations.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes, essential techniques and features DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation, concept of genetic code, Mendelism's and cocept of chromosomal aberrations.</p> <p><b>CO4 - Analyzing,</b> applying, remembering and understanding the detailed study related to concepts of genetic code, Mendelism's and cocept of chromosomal aberrations, DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation.</p> <p><b>CO5 - Evaluating,</b> analyzing, applying, remembering, and understanding the principle, methods, properties and functions of DNA structure and</p>



		<p>replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation, concept of genetic code, Mendelism's and cocept of chromosomal aberrations.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in concept of genetic code, Mendelism and concept of chromosomal aberrations, DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA editing</p>
MBTC-104	Biochemistry	<p><b>CO1- Remember</b> the define the terms and basic concepts of Biochemistry Enzyme metabolism, Mechanism and their different roles in biological systems, carbohydrates, proteins, fatty acids and nucleic acids.</p> <p><b>CO2- Understand</b> and Remember the principle, mechanism of basic and advanced Biochemistry.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed process of structure and function of biomolecules and enzymes.</p> <p><b>CO4- Analyzing,</b> applying, remembering, understanding the coordinated regulation of carbohydrate bisynthesis, Protein bisynthesis and lipid bisynthesis, nucleic acid bisynthesis and enzyme metabolic pathway.</p> <p><b>CO5- Evaluating, analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of enzymes and molecules.</p> <p><b>CO6- Constructing (Creating),</b> evaluating, analyzing, demonstrating, remembering, and understanding the Biomolecules and Enzymes.</p>
MBTC-201	Immunology	<p><b>CO1- Remember</b> the different basic concepts of introduction to Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and</p>

		<p>immunodiagnostics – RIA, ELISA.</p> <p><b>CO3– Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA.</p> <p><b>CO4– Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms.</p> <p><b>CO5– Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms.</p> <p><b>CO6– Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms.</p>
MBTC-202	Microbiology & Microbial Genetics	<p><b>CO1– Remember</b> the different concept of fundamentals, History and Evolution of Microbiology, microbial diversity, Cultivation and Maintenance of microorganisms, Microbial growth, Microbial Metabolism, Bacterial Reproduction, Control of Microorganisms, water microbiology and food microbiology.</p> <p><b>CO2– Understand</b> and remember the concept of fundamentals, History and Evolution of Microbiology, microbial diversity, Microbial growth, Microbial Metabolism, Bacterial Reproduction, Control of Microorganisms, water microbiology, food microbiology and Cultivation</p>

		<p>and Maintenance of microorganisms.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to different concept of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p>
MBTC-203	Molecular Endocrinology & Enzymology	<p><b>CO1- Remember</b> the basic concepts of general character of endocrine and enzymology, mechanism of hormone action: Signal discrimination, signal transduction, biosynthesis, control of secretion &amp; physiological actions of amino acid derived hormones, biosynthesis and control of secretion of adreno corticoids &amp; catecholamines &amp; their physiological actions, Historical perspectives of enzyme, enzyme technology and mechanism of enzyme action.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts and applications of endocrine and enzymology, mechanism of hormone action: Signal discrimination, signal transduction, biosynthesis, control of secretion &amp; physiological actions of amino acid derived hormones, biosynthesis and control of</p>

		<p>secretion of adreno corticoids &amp; catecholamines &amp; their physiological actions, Historical perspectives of enzyme, enzyme technology and mechanism of enzyme action.</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes and features of endocrine and enzymology, mechanism of hormone action: Signal discrimination, signal transduction, biosynthesis, control of secretion &amp; physiological actions of amino acid derived hormones, biosynthesis and control of secretion of adreno corticoids &amp; catecholamines &amp; their physiological actions, Historical perspectives of enzyme, enzyme technology and mechanism of enzyme action.</p> <p><b>CO4 -</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to endocrine and enzymology, mechanism of hormone action: Signal discrimination, signal transduction, biosynthesis, control of secretion &amp; physiological actions of amino acid derived hormones, biosynthesis and control of secretion of adreno corticoids &amp; catecholamines &amp; their physiological actions, Historical perspectives of enzyme, enzyme technology and mechanism of enzyme action.</p> <p><b>CO5-</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the endocrine and enzymology, mechanism of hormone action: Signal discrimination, signal transduction, biosynthesis, control of secretion &amp; physiological actions of amino acid derived hormones, biosynthesis and control of secretion of adreno corticoids &amp; catecholamines &amp; their physiological actions, Historical perspectives of enzyme, enzyme technology and mechanism of enzyme action.</p> <p><b>CO6-</b> <b>Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in endocrine and enzymology, mechanism of hormone action: Signal discrimination, signal transduction, biosynthesis, control of secretion &amp; physiological actions of amino acid derived hormones, biosynthesis and control of secretion of adreno corticoids &amp; catecholamines &amp; their physiological actions, Historical perspectives of enzyme, enzyme technology and mechanism of enzyme action.</p>
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MBTC-204	Biomaths, Computers Programming & Biostats, Applications	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character and concepts of biostatistics, Biomaths and computer applications: Relation of Life Science with mathematics, Types of Data, Measures biostatical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences. Introduction to Computers: Mini, micro, mainframe and super computers. Components of a computer system (CPU, I/O units).</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of measurement of biostatistics, Types of Data, Measures biostatical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences. Introduction to Computers: Mini, micro, mainframe and super computers. Components of a computer system (CPU, I/O units).</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of biostatical analysis, Types of Data, Measures biostatical analysis, Introduction to Computers: Mini, micro, mainframe and super computers. Components of a computer system (CPU, I/O units), Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to measurement of biostatical analysis, Types of Data, Measures biostatical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the measurement of biostatical analysis, Types of Data, Measures biostatical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in biostatical</p>
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		analysis, Types of Data, Measures biostatistical analysis, Probability classical & axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences. Introduction to Computers: Mini, micro, mainframe and super computers. Components of a computer system (CPU, I/O units).
MBTS-207	Epigenetics and Cancer Biology	<p><b>CO1-</b> Remember the basic concepts of Epigenetics and cancer Biology: Introduction, growth characteristics of cancers cells, cancer biology and biochemistry, carcinogenesis- radiation and chemical carcinogenesis, cell cycle regulation-tumor suppressor genes, apoptosis in cancer, detection of cancers, therapy, and immuno therapy and identification of targets for drug development.</p> <p><b>CO2-</b> <b>Understand</b> and remember the specific and basic concepts and applications of Remember the basic concepts of Epigenetics and cancer Biology: Introduction, growth characteristics of cancers cells, cancer biology and biochemistry, carcinogenesis- radiation and chemical carcinogenesis, cell cycle regulation-tumor suppressor genes, apoptosis in cancer, detection of cancers, therapy, and immuno therapy and identification of targets for drug development.</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes and features of Epigenetics and cancer Biology: Introduction, growth characteristics of cancers cells, cancer biology and biochemistry, carcinogenesis- radiation and chemical carcinogenesis, cell cycle regulation-tumor suppressor genes, apoptosis in cancer, detection of cancers, therapy, and immuno therapy and identification of targets for drug development.</p> <p><b>CO4-</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to Epigenetics and cancer Biology: Introduction, growth characteristics of cancers cells, cancer biology and biochemistry, carcinogenesis- radiation and chemical carcinogenesis, cell cycle regulation-tumor suppressor genes, apoptosis in cancer, detection of cancers, therapy, and immuno therapy and identification of targets for drug development.</p> <p><b>CO5-</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the Epigenetics and cancer Biology: Introduction, carcinogenesis- radiation</p>

		<p>and chemical carcinogenesis, cell cycle regulation-tumor suppressor genes, apoptosis in cancer, detection of cancers, therapy, and immuno therapy and identification of targets for drug development, growth characteristics of cancers cells, cancer biology and biochemistry.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Epigenetics and cancer Biology: Introduction, growth characteristics of cancers cells, cancer biology and biochemistry, carcinogenesis- radiation and chemical carcinogenesis, cell cycle regulation-tumor suppressor genes, apoptosis in cancer, detection of cancers, therapy, and immuno therapy and identification of targets for drug development. Hormone mediated carcinogenesis in humans.</p>
MBTS-208	Industrial Microbiology	<p><b>CO1- Remember</b> the different basic concepts of introduction to production of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes, essential techniques and features of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to concepts of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme</p>



		<p>kinetics.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics. Extracellular enzymes, Biotechnologically important intracellular products.</p>
MBTC-301	Recombination DNA Technology & Genomics	<p><b>CO1- Remember</b> the different basic concepts of introduction to molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of basic principle components of molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants. Develop understanding of various modern tools, instruments and RDT techniques and their utilization to solve the society and industry-related problems.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants. Apply the basic and advanced recombinant DNA techniques for higher studies, employment and advanced research in industrial and academic scale.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of molecular tools used in RDT and applications,</p>

		<p>Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants. Comprehend the range of molecular biology techniques for DNA or genome profiling, DNA sequencing/synthesis. Knowledge of the biological systems information and the explanation of the key concepts Omics technologies-genomics.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants. Demonstrate an understanding of transgenic technology and applications in health, agriculture and environment, alongwith associated social and environmental issues.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants. Acquire domain-specific knowledge and develop globally-relevant skills for academic and professional enhancement.</p>
MBTC-302	<b>Bioinformatics, Legal Biotechnology &amp; Bio Business Management</b>	<p><b>CO1-</b> Remember the different basic concepts of introduction to bioinformatics, legal biotechnology &amp; bio Business management: Introduction to bioinformatics, objectives, application and scopes, Sequence alignment and applications, legal and IPR issues in biotechnology, Worldwide market scenario of biotechnology based business and total product cost, capital investment and profitability, manufacturing and cost estimation for biological products for R &amp; D decision making.</p> <p><b>CO2-</b> Understand and remember the specific and basic concepts of basic principle components of bioinformatics, legal biotechnology &amp; bio Business management: Introduction to bioinformatics, objectives, application and scopes, Sequence alignment and applications, legal and IPR issues in biotechnology, Worldwide market scenario of biotechnology based business and total product cost, capital investment and profitability, manufacturing and cost estimation for biological products for R &amp; D decision making and their utilization to solve the society and industry-related problems.</p>

		<p><b>CO3- Applying,</b> understanding and remembering the detailed processes, essential techniques and features of bioinformatics, legal biotechnology &amp; bio Business management: Introduction to bioinformatics, objectives, application and scopes, Sequence alignment and applications, legal and IPR issues in biotechnology, Worldwide market scenario of biotechnology based business and total product cost, capital investment and profitability, manufacturing and cost estimation for biological products for R &amp; D decision making for higher studies, employment and advanced research in industrial and academic scale.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to concepts of bioinformatics, legal biotechnology &amp; bio Business management: Introduction to bioinformatics, objectives, application and scopes, Sequence alignment and applications, legal and IPR issues in biotechnology, Worldwide market scenario of biotechnology based business and total product cost, capital investment and profitability, manufacturing and cost estimation for biological products for R &amp; D decision making knowledge of the biological systems information and the explanation of the key concepts Omics technologies-genomics.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the principle, methods, properties and functions of bioinformatics, legal biotechnology &amp; bio Business management: Introduction to bioinformatics, objectives, application and scopes, Sequence alignment and applications, legal and IPR issues in biotechnology, Worldwide market scenario of biotechnology based business and total product cost, capital investment and profitability, manufacturing and cost estimation.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in bioinformatics, legal biotechnology &amp; bio Business management: Introduction to bioinformatics, objectives, application and scopes, Sequence alignment and applications, legal and IPR issues in biotechnology, Worldwide market scenario of biotechnology based business and total product cost, capital investment and profitability, manufacturing and marketing.</p>
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MBTE-304	Food and Beverages Biotechnology	<p><b>CO1-</b> <b>Remember</b> the different basic concepts of introduction to Development of scientific and analytical knowledge regarding various tools and techniques in the field of Food and Beverages Biotechnology. Food, Beverages &amp; Disease : Food borne illness due to bacterial food poisoning, infection and intoxication, Food and Microorganism Contamination and spoilage of different kinds of food &amp; beverages and Food hygiene.</p> <p><b>CO2-</b> <b>Understand</b> and remember the specific and basic concepts of basic principle components of tools and techniques in the field of Food and Beverages Biotechnology. Food, Beverages &amp; Disease : Food borne illness due to bacterial food poisoning, infection and intoxication, Food and Microorganism Contamination and spoilage of different kinds of food &amp; beverages and Food hygiene and their utilization to solve the society and industry-related problems.</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes, essential techniques and features of apply modern techniques in spoilage and contamination for solving various scientific problems in food industry and food and beverages related research institution. decision making for higher studies, employment and advanced research in industrial and academic scale.</p> <p><b>CO4-</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to demonstrate the scientific knowledge regarding safety regulations for handling of hazardous microbes, chemicals and food hygiene in the laboratory decision making Knowledge of the biological systems information and the explanation of the key concepts. Demonstrate the biotechnological principles and working food and feed.</p> <p><b>CO5-</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of the scientific knowledge regarding safety regulations for handling of hazardous microbes, chemicals and food hygiene in the laboratory decision making Knowledge of the biological systems information and the explanation of the key concepts of Food and Beverages Biotechnology. Demonstrate an understanding of</p>
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		<p>transgenic technology and applications in health, agriculture and environment, alongwith associated social and environmental issues.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in the scientific knowledge regarding safety regulations for handling of hazardous microbes, chemicals and food hygiene in the laboratory decision making Knowledge of the biological systems information and the explanation of the key concepts of Food and Beverages Biotechnology. Acquire domain-specific knowledge and develop globally-relevant skills for academic and professional enhancement.</p>
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MBTC-305	Research Methodology: Tools & Techniques	<p><b>CO1-</b> Remember the basic concepts of research methodology, tools and techniques: Acquire knowledge on measurement &amp; scaling techniques as well as the quantitative data analysis. Importance and need of scientific research, Fiel Survey, Site Selection, Source selection for data acquisition, Methods: Data collection, type of data, Qualitative and quantitative data, Measures if dispersion and project report.</p> <p><b>CO2-</b> <b>Understand</b> and remember the specific and basic concepts and applications of research methodology, tools and techniques: Acquire knowledge on measurement &amp; scaling techniques as well as the quantitative data analysis. Importance and need of scientific research, Fiel Survey, Site Selection, Source selection for data acquisition, Methods: Data collection, type of data, Qualitative and quantitative data, Measures if dispersion and project report.</p> <p><b>CO3-</b> <b>Applying,</b> understanding and remembering the detailed processes and features of research methodology, tools and techniques: Acquire knowledge on measurement &amp; scaling techniques as well as the quantitative data analysis. Importance and need of scientific research, Fiel Survey, Site Selection, Source selection for data acquisition, Methods: Data collection, type of data, Qualitative and quantitative data, Measures if dispersion and project report. Publication of scientific data, writing research paper and report.</p> <p><b>CO4-</b> <b>Analyzing,</b> applying, remembering and</p>
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		<p>understanding the detailed study related to research methodology, tools and techniques: Acquire knowledge on measurement &amp; scaling techniques as well as the quantitative data analysis. Importance and need of scientific research, Field Survey, Site Selection, Source selection for data acquisition, Methods: Data collection, type of data, Qualitative and quantitative data, Measures of dispersion and project report. Publication of scientific data, writing research paper and report.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the research methodology, tools and techniques: Acquire knowledge on measurement &amp; scaling techniques as well as the quantitative data analysis. Importance and need of scientific research, Field Survey, Site Selection, Source selection for data acquisition, Methods: Data collection, type of data, Qualitative and quantitative data, Measures of dispersion and project report. Publication of scientific data, writing research paper and report.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in research methodology, tools and techniques: Acquire knowledge on measurement &amp; scaling techniques as well as the quantitative data analysis. Importance and need of scientific research, Field Survey, Site Selection, Source selection for data acquisition, Methods: Data collection, type of data, Qualitative and quantitative data, Measures of dispersion and project report. Publication of scientific data, writing research paper and report.</p>
MBTE 306	Chemical Sciences & Biomaterials	<p><b>CO1- Remember</b> the different basic concepts and introduction to chemical sciences and biomaterials: Polymer materials, biocompatibility of biomaterials, cell: interactions with proteins and materials, the mechanical environment, interaction of bacteria with biomaterials, cardiovascular applications and drug targeting.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of basic principle components of tools and techniques in the field of chemical sciences and biomaterials: Polymer materials, biocompatibility of biomaterials, cell: interactions with proteins and materials, the mechanical environment, interaction of bacteria with biomaterials, cardiovascular applications and drug</p>

		<p>targeting and their utilization to solve the society and industry-related problems.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes, essential techniques and features of apply modern techniques in spoilage and contamination for solving various scientific problems in food industry and food and beverages related research institution. decision making for higher studies, employment and advanced research in industrial and academic scale.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to demonstrate the scientific knowledge of chemical sciences and biomaterials: Polymer materials, biocompatibility of biomaterials, cell: interactions with proteins and materials, the mechanical environment, interaction of bacteria with biomaterials, cardio vascular applications and drug targeting. Knowledge of the chemical sciences in biological systems information and the explanation of the key concepts. Demonstrate the biotechnological principles and working food and feed.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the principle, methods, properties and functions of chemical sciences and biomaterials: Polymer materials, biocompatibility of biomaterials, cell: interactions with proteins and materials, the mechanical environment, interaction of bacteria with biomaterials, cardio vascular applications and drug targeting. Knowledge of the chemical sciences in biological systems information and the explanation of the key concepts and applications in health, agriculture and environment, alongwith associated social and environmental issues.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in the scientific knowledge regarding chemical sciences and biomaterials: Polymer materials, biocompatibility of biomaterials, cell: interactions with proteins and materials, the mechanical environment, interaction of bacteria with biomaterials, cardio vascular applications and drug targeting. Knowledge of the chemical sciences in biological systems information and the explanation of the key concepts. Knowledge Acquire domain-specific knowledge and develop</p>
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			globally-relevant skills for academic and professional enhancement.
MBTE-307	Pharmaceutical Biotechnology & Drug Designing	CO1-	<b>Remember</b> the different basic concepts and introduction to Pharmaceutical Biotechnology & Drug Designing: Delivery considerations of biotechnological products, Drug targeting and drug delivery systems, Vaccines, drug design cycle and molecular modeling.
		CO2-	<b>Understand</b> and remember the specific and basic concepts of basic principle components of tools and techniques in the field of Pharmaceutical Biotechnology & Drug Designing: Delivery considerations of biotechnological products, Drug targeting and drug delivery systems, Vaccines, drug design cycle and molecular modeling and their utilization to solve the society and industry-related problems.
		CO3-	<b>Applying</b> , understanding and remembering the detailed processes, essential techniques and features of apply modern techniques in Pharmaceutical Biotechnology & Drug Designing: Delivery considerations of biotechnological products, Drug targeting and drug delivery systems, Vaccines, drug design cycle and molecular modeling.related research institution.decision making for higher studies, employment and advanced research in industrial and academic scale.
		CO4-	<b>Analyzing</b> , applying, remembering and understanding the detailed study related to demonstrate the scientific knowledge of Pharmaceutical Biotechnology & Drug Designing: Delivery considerations of biotechnological products, Drug targeting and drug delivery systems, Vaccines, drug design cycle and molecular modeling. Knowledge of the pharmaceutical sciences and drug designing in biological systems information and the explanation of the key concepts.
		CO5-	<b>Evaluating</b> , analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Pharmaceutical Biotechnology & Drug Designing: Delivery considerations of biotechnological products, Drug targeting and drug delivery systems, Vaccines, drug design cycle and molecular modeling. Knowledge of the pharmaceutical sciences and drug designing in biological systems information and the explanation of the key concepts and applications in health, agriculture and environment, alongwith

		<p>associated social and environmental issues.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in the scientific knowledge regarding Pharmaceutical Biotechnology &amp; Drug Designing: Delivery considerations of biotechnological products, Drug targeting and drug delivery systems, Vaccines, drug design cycle and molecular modeling. Knowledge Acquire domain-specific knowledge and develop globally-relevant skills for academic and professional enhancement.</p>
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MBTE-308	Plant Biotechnology	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of plant biotechnology, cryo and organogenic differentiation, types of culture, Somatic embryogenesis and production of synthetic seeds , In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria.</p>
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		<p>Control mechanisms and manipulation, Somaclonal variation nomenclature, methods, applications basis and</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Biofertilisers, Ecological risks of transgenic crop and global market, Biodiversity and its conservation Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p>
MBTE-309	Advanced Bioinformatics	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data</p>

			identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.
MBTS-311	Bio –Entrepreneurship	<p><b>CO1-</b> <b>Remember</b> and define the terms and basic concepts of entrepreneurship development and their different roles to influencing entrepreneurship, features of a successful Entrepreneurship</p> <p><b>CO2-</b> <b>Understand</b> and Remember the introduction and principle, mechanism of entrepreneurship, features, financing the enterprise, marketing management and entrepreneurship and international business.</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes of mechanism of entrepreneurship, features, financing the enterprise, marketing management and entrepreneurship and international business.</p> <p><b>CO4-</b> <b>Analyzing</b>, Applying, remembering, understanding the detailed and complete study related to Biotechnological entrepreneurship features for the growth or individual person and society</p> <p><b>CO5-</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the properties of mechanism of entrepreneurship, features, financing the enterprise, marketing management and entrepreneurship and international business.</p> <p><b>CO6-</b> <b>Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the entrepreneurship and the awareness, appreciation and applicability in environment, and their diverse functions.</p>	
MBTS-312	IPR, Patenting and Bioethics	<p><b>CO1-</b> <b>Remember</b> the different basic concepts of introduction to Indian Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety.</p> <p><b>CO2-</b> <b>Understand</b> and remember the specific and basic concepts of Indian Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO4-</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and</p>	

		<p><b>CO5-</b> Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP). <b>Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO6-</b> <b>Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p>
MBTS - 313	Biomedical Technology	<p><b>CO1-</b> <b>Remember</b> the different basic concepts and introduction to Biomedical technology: Molecular diagnosis, RDT, Reproductive Health Technologies, Mutations and genetic disorders, Types and grading of cancer, molecular diagnosis of cancer, Chemical mutagens and cellular pathology.</p> <p><b>CO2-</b> <b>Understand</b> and remember the specific and basic concepts of Biomedical technology: Molecular diagnosis, RDT, Reproductive Health Technologies, Mutations and genetic disorders, Types and grading of cancer, molecular diagnosis of cancer, Chemical mutagens and cellular pathology and their utilization to solve the society and industry-related problems.</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes, essential techniques and features of apply modern techniques in Biomedical technology: Molecular diagnosis, RDT, Reproductive Health Technologies, Mutations and genetic disorders, Types and grading of cancer, molecular diagnosis of cancer, Chemical mutagens and cellular pathology and their utilization to solve the society and industry-related problems and decision making for higher studies, employment and advanced research in industrial and academic scale.</p> <p><b>CO4-</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to demonstrate the scientific knowledge of Biomedical technology: Molecular diagnosis, RDT, Reproductive Health Technologies, Mutations and genetic disorders, Types and grading of cancer, molecular diagnosis of cancer, Chemical mutagens and cellular pathology and their utilization to solve the society and industry-related problems. Knowledge of the Biomedical technology in biological systems information and the explanation of the key concepts.</p>

		<p><b>CO5-</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Biomedical technology: Molecular diagnosis, RDT, Reproductive Health Technologies, Mutations and genetic disorders, Types and grading of cancer, molecular diagnosis of cancer, Chemical mutagens and cellular pathology and their utilization to solve the society and industry-related problems</p> <p><b>CO6-</b> <b>Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in the scientific knowledge regarding Biomedical technology: Molecular diagnosis, RDT, Reproductive Health Technologies, Mutations and genetic disorders, Types and grading of cancer, molecular diagnosis of cancer, Chemical mutagens and cellular pathology and their utilization to solve the society and industry-related problems.</p>
MBTS-314	Genomics and Proteomics	<p><b>CO1-</b> <b>Remember</b> the different basic concepts of introduction to general character of genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO2-</b> <b>Understand</b> and remember the specific and basic concepts of genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes and features of Mass spectrometry based methods for protein identification, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO4-</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO5-</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and</p>

		<p>protein sequencing.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p>
MBTC-401	Cell & Tissue Culture	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation. Plasmids and vectors.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation, methods, applications basis and disadvantages.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation. Plasmids and vectors.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation. Plasmids and vectors.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, cell and tissue culture, cryo and organogenic differentiation, types of culture, <i>In vitro</i> haploid production, protoplast Isolation and fusion and Plant</p>



		Somaclonal variation nomenclature, methods, applications basis and disadvantages. equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning & cell transformation.
MBTC-402	Environmental Biotechnology & Bioprocess Engineering	<p><b>CO1- Remember</b> the basic concepts of general character of environmental biotechnology and bioprocess technology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching. Environmental significance of genetically modified microbes, plants and animals.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts and applications environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of Environmental significance of genetically modified microbes, plants and animals, environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers, Bioleaching and bioprocess technology.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals. Bioprocess technology.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the environmental biotechnology and bioprocess technology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in environmental biotechnology and bioprocess technology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals. Global Environmental problems.</p>

MBTE-404	Dissertation	<p><b>CO1-</b> <b>Remember</b> the different basic concepts and introduction to Dissertation: <b>Acquire ability to analyze scientific advancements to identify a research area, design objectives and</b> utilize modern tools, e-resources for literature survey. Demonstrate technical skills to conduct experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution / conclusion to complex problem.</p> <p><b>CO2-</b> <b>Understand</b> and remember the specific and basic concepts of Dissertation: <b>Acquire ability to analyze scientific advancements to identify a research area, design objectives and</b> utilize modern tools, e-resources for literature survey. Demonstrate technical skills to conduct experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution/conclusion to complex problem. Exhibit competent scientific writing (with critical analysis) and enhance presentation skills.</p> <p><b>CO3-</b> <b>Applying</b>, understanding and remembering the detailed processes, essential techniques and features of apply modern techniques in Dissertation: <b>Acquire ability to analyze scientific advancements to identify a research area, design objectives and</b> utilize modern tools, e-resources for literature survey. Demonstrate technical skills to conduct experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution/ conclusion to complex problem and decision making for higher studies, employment and advanced research in industrial and academic scale.</p> <p><b>CO4-</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to demonstrate the scientific knowledge of Dissertation: <b>Acquire ability to analyze scientific advancements to identify a research area, design objectives and</b> utilize modern tools, e-resources for literature survey. Demonstrate technical skills to conduct experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution / conclusion to complex problem. Knowledge of the dissertation in research of biological systems information and the explanation of the key concepts.</p> <p><b>CO5-</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Dissertation: <b>Acquire ability to analyze scientific advancements to identify a research area, design objectives and</b> utilize modern tools, e-resources for literature survey. Demonstrate technical skills to conduct</p>
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		<p>experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution / conclusion to complex problem. Exhibit competent scientific writing (with critical analysis) and enhance presentation skills.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part the scientific knowledge regarding Dissertation: <b>Acquire ability to analyze scientific advancements to identify a research area, design objectives and utilize modern tools, e-resources for literature survey. Demonstrate technical skills to conduct experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution / conclusion to complex problem. Exhibit competent scientific writing (with critical analysis) and enhance presentation skills.and their utilization to solve the society and industry-related problems.</b></p>
MBTS-405	Enzyme Technology	<p><b>CO1- Remember</b> the different basic concepts and introduction to enzyme technology: effect of temperature, pH and substrate concentration on reaction rate. Interpret the application of Michaelis - Menten equation and enzyme kinetics. Understand and illustrate mechanism of enzyme action, Enzyme Inhibition, Enzyme catalysis, vitamins and coenzymes. Compare different methods of enzyme immobilization and analyze their respective industrial application, functional relationship of enzyme.</p> <p><b>CO2- Understand</b> and remember the specific concepts of enzyme technology: effect of temperature, pH and substrate concentration on reaction rate. Interpret the application of Michaelis-Menten equation and enzyme kinetics. Understand and illustrate mechanism of enzyme action, Enzyme Inhibition, Enzyme catalysis, vitamins and coenzymes. Compare different methods of enzyme immobilization and analyze their respective industrial application, functional relationship of enzyme. Exhibit competent scientific writing (with critical analysis) and enhance presentation skills.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes, essential techniques and features of enzyme technology: effect of temperature, pH and substrate concentration on reaction rate. Interpret the application of Michaelis - Menten equation and enzyme kinetics. Understand and illustrate mechanism of enzyme action, Enzyme Inhibition, Enzyme catalysis, vitamins and coenzymes. Compare different methods of enzyme immobilization and analyze their respective industrial application, functional relationship of enzyme. Demonstrate</p>

		<p>technical skills to conduct experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution/ conclusion to complex problem and decision making for higher studies, employment and advanced research in industrial and academic scale.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to demonstrate the scientific knowledge of enzyme technology: effect of temperature, pH and substrate concentration on reaction rate. Interpret the application of Michaelis - Menten equation and enzyme kinetics. Understand and illustrate mechanism of enzyme action, Enzyme Inhibition, Enzyme catalysis, vitamins and coenzymes. Compare different methods of enzyme immobilization and analyze their respective industrial application, functional relationship of enzyme.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of enzyme technology: effect of temperature, pH and substrate concentration on reaction rate. Interpret the application of Michaelis - Menten equation and enzyme kinetics. Understand and illustrate mechanism of enzyme action, Enzyme Inhibition, Enzyme catalysis, vitamins and coenzymes. Compare different methods of enzyme immobilization and analyze their respective industrial application, functional relationship of enzyme. Exhibit competent scientific writing (with critical analysis) and enhance presentation skills.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part the enzyme technology: effect of temperature, pH and substrate concentration on reaction rate. Interpret the application of Michaelis - Menten equation and enzyme kinetics. Understand and illustrate mechanism of enzyme action, Enzyme Inhibition, Enzyme catalysis, vitamins and coenzymes. Compare different methods of enzyme immobilization and analyze their respective industrial application, functional relationship of enzyme.</p>
MBTS-406	Molecular Virology and Infections	<p><b>CO1- Remember</b> the different basic concepts and introduction to Molecular virology and infections: History of Virology and Biosafety, Virus Replication, Interferon and Antiviral Agents, Cultivation of Viruses and Viral Vaccines, Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods.</p> <p><b>CO2- Understand</b> and remember the specific concepts of Molecular virology and infections: History of Virology and Biosafety, Virus Replication, Interferon and Antiviral Agents, Cultivation of Viruses and</p>

		<p>Viral Vaccines, Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods. Exhibit competent scientific writing (with critical analysis) and enhance presentation skills.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Molecular virology and infections: History of Virology and Biosafety, Virus Replication, Interferon and Antiviral Agents, Cultivation of Viruses and Viral Vaccines, Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods. Demonstrate technical skills to conduct experiments operate various analytical techniques and instruments, and ability to interpret data to derive a solution/ conclusion to complex problem of virology and infections.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to demonstrate the scientific knowledge of Molecular virology and infections: History of Virology and Biosafety, Virus Replication, Interferon and Antiviral Agents, Cultivation of Viruses and Viral Vaccines, Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Molecular virology and infections: History of Virology and Biosafety, Virus Replication, Interferon and Antiviral Agents, Cultivation of Viruses and Viral Vaccines, Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods. Exhibit competent scientific writing (with critical analysis) and enhance presentation skills.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Molecular virology and infections: History of Virology and Biosafety, Virus Replication, Interferon and Antiviral Agents, Cultivation of Viruses and Viral Vaccines, Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods.</p>
MBTS-407	Basics of Forensic Science	<p><b>CO1- Remember</b> the different basic concepts of introduction and principles of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of forensic science, forensic science laboratory and its organization and service,</p>

		<p>Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of crime scene detection methods, forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p>
MBTS-408	Agriculture Biotechnology	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of agriculture biotechnology, crop hybridization and differentiation, Agricultural microbiology, Different methods of gene transfer to plant, transgenesis, Plant Genetic Engineering and gene modification in agriculture.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of agriculture biotechnology, crop hybridization and differentiation, Agricultural microbiology, Different methods of gene transfer to plant, transgenesis, Plant Genetic Engineering and gene modification in agriculture, methods, applications basis and disadvantages.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and</p>

		<p>fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to agriculture biotechnology, crop hybridization and differentiation, Agricultural microbiology, Different methods of gene transfer to plant, transgenesis, Plant Genetic Engineering and gene modification in agriculture.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the agriculture biotechnology, crop hybridization and differentiation, Agricultural microbiology, Different methods of gene transfer to plant, transgenesis, Plant Genetic Engineering and gene modification in agriculture methods, applications basis and disadvantages.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in agriculture biotechnology, crop hybridization and differentiation, Agricultural microbiology, Different methods of gene transfer to plant, transgenesis, Plant Genetic Engineering and gene modification in agriculture. Applications of agriculture biotechnology.</p>
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**SHRI GURU RAM RAI UNIVERSITY**  
(Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017)  
**PATEL NAGAR, DEHRADUN-248001, UTTARAKHAND**

**BACHELOR OF SCIENCE**

**Program Outcome (PO)**

<b>PO-1</b>	Bachelor of Science offers theoretical as well as practical knowledge about different subject areas.
<b>PO-2</b>	Graduates will develop scientific temperament to solve scientific problems in emerging areas of science at National and International level.
<b>PO-3</b>	Graduates will acquire coherent understanding of the academic field to pursue multi and interdisciplinary science careers in future.
<b>PO-4</b>	Graduate will have clarity of thought and expression. Qualities like logical thinking and decision making will be enhanced
<b>PO-5</b>	Graduates plan and execute experiments or investigations, analyze and interpret data information collected using appropriate methods
<b>PO-6</b>	Graduates will be able to compete in various national and international competitive examinations.
<b>PO-7</b>	Graduates will understand the principles of basic and applied sciences and apply them logically in environmental and socio-technological context with a systematic approach towards sustainable development.
<b>PO-8</b>	Graduates will have critical thinking, follow innovations and developments in Science and technology
<b>PO-9</b>	Graduates will acquire effective communication skills
<b>PO-10</b>	Graduates will understand ethical principles and responsibilities for effective citizenship.
<b>PO-11</b>	Graduates will develop new and enhancing conversational skills that lead to not only to good communication but also to the excellent drafting abilities linked with technical reports and presentations.
<b>PO-12</b>	Graduates will competent enough for doing jobs in Govt. and private sectors of academia, research and industry.

**B.Sc. BOTANY**

**Program Specific Outcome (PSO)**

<b>PSO-1</b>	Remember and understand the biodiversity of Microbes, Algae, Fungi and Archegoniate
<b>PSO-2</b>	Apply and Explain the basics of Plant Ecology and Taxonomy, Genetics and Plant Breeding
<b>PSO-3</b>	Analyze and Summarize the concepts and applications of plant systematic and Embryology, Economic botany and Biotechnology.
<b>PSO-4</b>	Learn to develop the key concepts of plant physiology and Metabolism and apply the knowledge of Medicinal botany, Nursery and Gardening, Floriculture and Industrial and Environmental Microbiology.

**Course Outcome (CO)**

<b>Course Code</b>	<b>Course Name</b>	<b>Outcome</b>
BBOC101	Biodiversity (Microbes, Algae, Fungi and Archegoniate)	<p><b>CO1-</b> Remember to define and select the morphological diversity among Bacteria, Viruses, Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.</p> <p><b>CO2-</b> Understand to describe, discuss and distinguish vegetative and reproductive parts of various life forms including bacteria, viruses, algae, fungi and archegoniate.</p> <p><b>CO3-</b> Apply to explain and write the status of Algae, Fungi, Bryophyte, Pteridophyte and Gymnosperm as a group in plant kingdom.</p> <p><b>CO4-</b> Analyze to differentiate, explain the life cycle of selected genera.</p> <p><b>CO5-</b> Evaluate to summarize, justify and select the economic and ecological importance of these plant groups.</p> <p><b>CO6-</b> Create to develop, write or construct morphology anatomy and reproduction of algae, bryophytes, pteridophytes and gymnosperms.</p>
BBOL101	Lab Course	<p><b>CO1-</b> Remember the instruments, techniques, lab etiquette and good lab practices for working in a microbiology laboratory.</p> <p><b>CO2-</b> Understand to Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes. Learn to identify algae, lichens and plant pathogens along with their symbiotic and parasitic associations.</p> <p><b>CO3-</b> Apply a knowledge base in understanding diversity, economic values &amp; taxonomy of bryophytes.</p> <p><b>CO4-</b> Analyze morphology, anatomy, reproduction and developmental changes therein through typological study.</p> <p><b>CO5-</b> Evaluate by observation and table study of representative members of phylogenetically important groups to learn the process of evolution in a broad sense.</p> <p><b>CO6-</b> learn to create their small digital reports where they can capture the zoomed in and zoomed out picture as well as videos in case they are able to find some rare structure or phenomenon related to Bryophytes.</p>
BBOC201	Plant Ecology and Taxonomy	<p><b>CO1-</b> Remember to define various components of environment and ecosystem and taxonomic terminology.</p> <p><b>CO2-</b> Understand to describe, discuss, distinguish and identify plants which belong to dicot and monocot families.</p> <p><b>CO3-</b> Apply to explain the basic principles of classification of angiosperm plants.</p> <p><b>CO4-</b> Analyze to differentiate and explain structure and functions of ecosystem, food chain and food web.</p>

		<p><b>CO5-</b> Evaluate to summarize, justify and select plant community and succession.</p> <p><b>CO6-</b> Create to develop, write or construct Biogeochemical cycling in nature</p>
BBOL201	Lab Course	<p><b>CO1-</b> Remember the knowledge of instruments used to measure microclimatic variables</p> <p><b>CO2-</b> Understand vegetative and floral characters of locally available families</p> <p><b>CO3-</b> Apply practical knowledge implemented in the biodiversity assessment and conservation.</p> <p><b>CO4-</b> Analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test</p> <p><b>CO5-</b> Evaluate morphological adaptations of hydrophytes and xerophytes</p> <p><b>CO6-</b> Create a knowledge base in understanding the basis of plant diversity, economic values &amp; taxonomy of plants.</p>
BBOC301	Plant Anatomy and Embryology	<p><b>CO1-</b> Remember to define and Understand the habit of the angiosperm plant body, the vegetative characteristics of the plant, various tissue systems; the normal and anomalous secondary growth in plants and their causes.</p> <p><b>CO2-</b> Understand to describe, discuss and distinguish the Endosperm types, structure and functions; Dicot and monocot embryo; Embryo-endosperm relationship.</p> <p><b>CO3-</b> Apply to explain and write about Vascular cambium – structure and function, seasonal activity. Secondary growth, Epidermis, cuticle, stomata.</p> <p><b>CO4-</b> Analyze to explain general account of adaptations in xerophytes and hydrophytes and differentiate Wood (heartwood and sapwood).</p> <p><b>CO5-</b> Evaluate to summarize and justify about Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.</p> <p><b>CO6-</b> Create to develop, construct or write about the apomixis and polyembryony with their practical applications.</p>
BBOL301	Lab Course	<p><b>CO1-</b> Remember tissue structure leaf morphology.</p> <p><b>CO2-</b> Understand cell structure, secondary growth and adaptive anatomy in plants.</p> <p><b>CO3-</b> Apply to explain the pollination and seed dispersal mechanism.</p> <p><b>CO4-</b> Analyze to differentiate cell structure in dicot and monocot</p> <p><b>CO5-</b> Evaluate to summarize or justify adaptive anatomy of Xerophyte, Hydrophyte</p> <p><b>CO6-</b> Create or develop or write structure of ovules and female gametophytes</p>
BBOS302	Mushroom Culture Technology	<p><b>CO1-</b> Remember the history and scope of mushroom cultivation</p> <p><b>CO2-</b> Describe the steps and requirements of mushroom culture technology</p>

		<p><b>CO3-</b> Explain about the various methods which can be used for the storage of mushrooms</p> <p><b>CO4-</b> Analyze about the cost benefit ratio, marketing in India and abroad and export value of Mushroom</p> <p><b>CO5-</b> Evaluate and measure about processing of edible mushrooms.</p> <p><b>CO6-</b> Explain the types of foods prepared from edible mushrooms</p>
BBOC401	Plant Physiology and Metabolism	<p><b>CO1-</b> Define basic concepts of physiology and metabolism</p> <p><b>CO2-</b> Understand the plants and plant cells in relation to water, nutrition, photosynthetic pathways and respiration</p> <p><b>CO3-</b> Explain about the movement of sap and absorption of water in plant body</p> <p><b>CO4-</b> Analyze the plant, growth, flowering, movement, light response, dormancy and germination.</p> <p><b>CO5-</b> Summarize the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways, respiration in higher plants with particular emphasis on aerobic and anaerobic respiration, ATP synthesis and nitrogen metabolism.</p> <p><b>CO6-</b> Develop or write the role of phytohormone in plant growth and Nitrogen assimilation.</p>
BBOL401	Lab Course	<p><b>CO1-</b> Gain knowledge of determination of osmotic potential of plant cell sap</p> <p><b>CO2-</b> Understand effect of environmental factors on transpiration.</p> <p><b>CO3-</b> Apply the formula to calculate the stomatal index and frequency of plant leaf</p> <p><b>CO4-</b> Analyze the separation of aminoacids by chromatography</p> <p><b>CO5-</b> Evaluate the rate of respiration by Respirometer</p> <p><b>CO6-</b> Develop to demonstrate suction due to transpiration</p>
BBOS402	Medicinal Botany	<p><b>CO1-</b> Define various types of medicines with their functions.</p> <p><b>CO2-</b> Identify the medicinal plants with their applications.</p> <p><b>CO3-</b> Explain the botanical name, family and plant parts used for human welfare.</p> <p><b>CO4-</b> Analyze the process of propagation of medicinal plants.</p> <p><b>CO5-</b> Evaluate the applications of natural products to certain diseases.</p> <p><b>CO6-</b> Create green house for nursery preparation of medicinal plants</p>
BBOS403	Plant Diversity and Human Welfare	<p><b>CO1-</b> Remember to define or select the role of diversity of plants and microbes and their uses.</p> <p><b>CO2-</b> Understand causes of loss of biodiversity and its management.</p> <p><b>CO3-</b> Explain and apply process of conservation of biodiversity.</p> <p><b>CO4-</b> Analyze or explain the functions of government acts and bodies for the conservation</p>

		<p><b>CO5-</b> Evaluate or summarize role of plants in relation to Human Welfare and commercial importance: forestry and forest products, avenue trees, ornamental plants, alcoholic beverages, Fruits and nuts.</p> <p><b>CO6-</b> Develop or write the various approaches of conservation of biodiversity</p>
BBOS404	Intellectual Property Rights	<p><b>CO1-</b> Define introductory aspects of Intellectual property rights.</p> <p><b>CO2-</b> Describe the objectives and rights of patents.</p> <p><b>CO3-</b> Explain the copyright law and transfer of copyright.</p> <p><b>CO4-</b> Analyze and learn about the trademarks.</p> <p><b>CO5-</b> Predict about the geographical indications.</p> <p><b>CO6-</b> Write or manage the protection of traditional knowledge.</p>
BBOD501	Economic Botany and Biotechnology	<p><b>CO1-</b> Remember the role of plants and biotechnology in human welfare. Students will be able to gain the knowledge of Origin of Cultivated Plants, Cereals, Legumes, Spices, Oils and Fats, Fiber Yielding Plants, Medicinal Plants, Plant tissue culture and Recombinant DNA Techniques.</p> <p><b>CO2-</b> Understand the economic uses of various plants.</p> <p><b>CO3-</b> Develop the Knowledge of plant products and its utility and techniques of biotechnology.</p> <p><b>CO4-</b> Analyze the economically useful plants &amp; techniques of biotechnology.</p> <p><b>CO5-</b> Evaluate the basic concept of biotechnology and its application with reference to plants.</p> <p><b>CO6-</b> Develop the knowledge of plant part use as in medical form, beverage form, Fodder and Forage from etc.</p>
BBOL501	Lab Course	<p><b>CO1-</b> Recognize &amp; remember the economic important plant parts and molecular techniques used in biotechnology.</p> <p><b>CO2-</b> Discuss the specimens of economic important plants.</p> <p><b>CO3-</b> Practice the section cuttings.</p> <p><b>CO4-</b> Analyze the knowledge of Familiarization with basic equipments in tissue culture.</p> <p><b>CO5-</b> Test the biomolecules by micro-chemical tests.</p> <p><b>CO6-</b> Assemble the knowledge of Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation</p>
BBOD502	Cell and Molecular Biology	<p><b>CO1-</b> Remember the principles and details of using light and electron microscopes and the role of X-ray diffraction in studying the structures of cellular organelles and biomolecules and Define various types of cell organelles and their functions</p> <p><b>CO2-</b> Identify the role of enzymes in plant development.</p> <p><b>CO3-</b> Explain the basic principles of microscopy.</p> <p><b>CO4-</b> Analyze the process of cell cycle with reference to</p>

		<p>mitosis and meiosis.</p> <p><b>CO5-</b> Compare and Discuss about the SEM and TEM with reference to their applications in plant study.</p> <p><b>CO6-</b> Construct the structures of different RNA and enzymes used in transcription</p>
BBOL502	Lab Course	<p><b>CO1-</b> Examine various cell organelles through slides and photographs.</p> <p><b>CO2-</b> Gain understanding of temporary mount and slides</p> <p><b>CO3-</b> Determine to demonstrate dialysis of starch and simple sugar</p> <p><b>CO4-</b> Illustrate the structure of nuclear pore complex by photograph.</p> <p><b>CO5-</b> Measure the cell size (either length or breadth/diameter) by micrometry</p> <p><b>CO6-</b> Test the process of plasmolysis and deplasmolysis on Rhoeo leaf</p>
BBOD503a	Analytical Techniques in Plant Sciences	<p><b>CO1-</b> Define various terms used in microscopy and biostatistics</p> <p><b>CO2-</b> Understand process of microscopy, spectrophotometry and chromatography.</p> <p><b>CO3-</b> Explain the formulae of biostatistics with suitable examples.</p> <p><b>CO4-</b> Analyze the characteristics of proteins and nucleic acids.</p> <p><b>CO5-</b> Summarize the applications of different techniques used in plant science.</p> <p><b>CO6-</b> Create or write the applications of paper chromatography, column chromatography, TLC, GLC, HPLC</p>
BBOL503a	Lab Course	<p><b>CO1-</b> Remember and observe the details of Microscopy- Principles of light microscopy, electron microscopy (TEM and SEM).</p> <p><b>CO2-</b> Understand and describe Chromatography and</p> <p><b>CO3-</b> Explain the methods used in Micrometry, Microtomy and Microphotography</p> <p><b>CO4-</b> Differentiate the blotting techniques</p> <p><b>CO5-</b> Assess separation of chloroplast pigments by paper chromatography</p> <p><b>CO6-</b> Prepare permanent slides by double staining</p>
BBOD503b	Natural Resource Management	<p><b>CO1-</b> Define and select national and international initiatives, and policies adopted in natural resources management and conservation IUCN, UNESCO, UNEP, IBIN, WBBDB, BSI, ZSI</p> <p><b>CO2-</b> Understand natural resources, Sustainable</p> <p><b>CO3-</b> Explain about utilization, degradation, and management of energy, land, water and Biological Resources i.e. Bio-prospecting, Forest products; IPR; CBD; National Biodiversity Action Plan.</p> <p><b>CO4-</b> Explain about contemporary practices in resource management; EIA, GIS, Participatory Resource</p>

		<p>Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.</p> <p><b>CO5-</b> Measure dominance of woody species by DBH (diameter at breast height) method</p> <p><b>CO6-</b> Plan and prepare strategies for sustainable natural resources management.</p>
BBOL503b	Lab Course	<p><b>CO1-</b> Examine solid waste generated and its impact on land degradation</p> <p><b>CO2-</b> Identify protocol for collection of data on forest cover.</p> <p><b>CO3-</b> Calculate ecological or carbon footprint</p> <p><b>CO4-</b> Analyse and interpret the physico-chemical properties of water samples</p> <p><b>CO5-</b> Measure dominance woody species in specific forest</p> <p><b>CO6-</b> Compilation of field based experimental data</p>
BBOS504	Herbal Technology	<p><b>CO1-</b> Remember and define role of medicinal plants, their cultivation, harvesting, processing, storage, marketing and utilization.</p> <p><b>CO2-</b> Understand uses of herbs in curing various ailments.</p> <p><b>CO3-</b> Explain phytochemistry of medicinal plants.</p> <p><b>CO4-</b> Analyze the systematic position and medicinal uses of some important plants like Tulsi, Ginger, Fenugreek, Indian Goose Berry and Ashoka.</p> <p><b>CO5-</b> Evaluate drug adulteration- types and methods of drug evaluation biological testing of herbal drugs for secondary metabolites</p> <p><b>CO6-</b> Plan or prepare to cultivate medicinal plants in lab through micropropagation</p>
BBOS505	Nursery and Gardening	<p><b>CO1-</b> Describe the objectives and scope of Nursery, Gardening and cultivation of various vegetables.</p> <p><b>CO2-</b> Explain about the structure and types of seed, seed dormancy, Seed production technology, seed testing and certification etc.</p> <p><b>CO3-</b> Illustrate the methods of Nursery, Gardening and vegetative propagation.</p> <p><b>CO4-</b> Analyze the definition, objectives and scope of different types of Nursery &amp; gardening</p> <p><b>CO5-</b> Summarized the knowledge sowing and raising of seeds and seedlings, transplanting and cultivation of seedlings and marketing procedures of vegetables.</p> <p><b>CO6-</b> Design the idea of Nursery and Gardening.</p>
BBOS506	Floriculture	<p><b>CO1-</b> Remember the definition, objectives and scope of Nursery and Gardening</p> <p><b>CO2-</b> Understanding about the structure and types of seed,</p> <p><b>CO3-</b> Apply the methods of vegetative propagation.</p>



		<b>CO4-</b> Analyze the flower production process and diseases of ornamental plants <b>CO5-</b> Measure sowing and raising of seeds and seedlings, transplanting and cultivation of seedlings and marketing procedures of the following vegetables: <b>CO6-</b> Create landscape places of public importance
BBOS507	Plant Curious Fascinating Plants	<b>CO1-</b> Define habitat and ecology <b>CO2-</b> Understand about morphology and functions of strange plants <b>CO3-</b> Write about strategies of plants to survive in extreme conditions <b>CO4-</b> Explain morphological modifications, adaptation on plants <b>CO5-</b> Differentiate plants on the basis of unique morphology and functions <b>CO6-</b> Assess floral diversity in Indian and Himalayan region
BBOD601a	Bioinformatics	<b>CO1-</b> Remember and define scope, branches and Research areas of Bioinformatics, Biological Databases, information submission to and retrieval from databases. <b>CO2-</b> Understand, handle and analyze nucleic acid and protein sequences, perform multiple sequence alignments, and Phylogenetic Analyses using different computational tools. <b>CO3-</b> Predict the molecular phylogenetic relationships of the taxa. <b>CO4-</b> Explain applications of Bioinformatics: Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement. <b>CO5-</b> Measure tools and applications of NCBI and other databases <b>CO6-</b> Design Methods of Phylogeny, Software for Phylogenetic Analyses
BBOL601a	Lab Course	<b>CO1-</b> Gain Knowledge of Nucleic acid and protein database. <b>CO2-</b> Gain understanding, hands-on training <b>CO3-</b> Apply the construction of phylogenetic tree. <b>CO4-</b> Analyze sequence alignment and similarity searching tools <b>CO5-</b> Evaluate various tools involved in genome annotation <b>CO6-</b> Collaborate informatics with structure and function
BBOD601b	Industrial and Environmental Microbiology	<b>CO1-</b> Know about design of bioreactors, factors affecting growth and production <b>CO2-</b> Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air

		<p><b>CO3-</b> Explain the different types of fermentation processes</p> <p><b>CO4-</b> Calculate estimation of microorganism from soil and water</p> <p><b>CO5-</b> Measure occurrence, abundance and distribution of microorganism in the environment and their role in the environment and also learn different methods for their detection</p> <p><b>CO6-</b> Write role of microbes in sewage and domestic waste water treatment systems</p>
BBOL601b	Lab Course	<p><b>CO1-</b> Gain Knowledge about Functioning of instrument</p> <p><b>CO2-</b> Gain Understanding about preparation of different culture media</p> <p><b>CO3-</b> Determine alcohol production by yeast using sugar</p> <p><b>CO4-</b> Estimate determination of BOD, COD, TDS, TOC and coliforms from water samples</p> <p><b>CO5-</b> Measure microorganisms from water and soil and air</p> <p><b>CO6-</b> Develop protocol for the determination of coliforms in water samples</p>
BBOD602	Research Methodology	<p><b>CO1-</b> Remember laboratory practices and acquire the knowledge about the common toxic chemicals and safety measures during their handling.</p> <p><b>CO2-</b> Understand ability to review literature and documenting, and presenting data in a format suitable for publication in peer-reviewed journals</p> <p><b>CO3-</b> Apply Knowledge of major instruments required to conduct research work</p> <p><b>CO4-</b> Analyze technical aspects and essential requirements of tissue culture technology</p> <p><b>CO5-</b> Evaluation of data, data collection and presentations.</p> <p><b>CO6-</b> Create statistical tools for interpretation of data, and testing of hypothesis.</p>
BBOL602	Lab Course	<p><b>CO1-</b> Gain knowledge of practical based on chemical calculation</p> <p><b>CO2-</b> Gain understanding of plant micro technique</p> <p><b>CO3-</b> Apply to make images through microphotography</p> <p><b>CO4-</b> Explain technical report writing</p> <p><b>CO5-</b> Justify the research through presentation</p> <p><b>CO6-</b> Validate ethical guidelines</p>
BBOD603	Dissertation	<p><b>CO1-</b> Record awareness and interest towards research.</p> <p><b>CO2-</b> Understand scientific temperament.</p> <p><b>CO3-</b> Apply the fundamentals of research methodology.</p> <p><b>CO4-</b> Organize skills for the writing of thesis and scientific papers.</p> <p><b>CO5-</b> Evaluate to derive a solution</p> <p><b>CO6-</b> Solve problem based on observation</p>
BBOL603	Lab Course	<p><b>CO1-</b> Remember the basic concept of Research</p> <p><b>CO2-</b> Understand and identify a research area</p> <p><b>CO3-</b> Apply technical skills to conduct experiments</p>

		<p><b>CO4-</b> Explain various analytical techniques and instruments</p> <p><b>CO5-</b> Test competent scientific writing and enhance presentation skills.</p> <p><b>CO6-</b> Solve data to derive a solution / conclusion to complex problem.</p>
BBOD604	Genetics and Plant Breeding	<p><b>CO1-</b> Describe the properties of hereditary, Sex-determination and Sex-linked Inheritance Linkage and Crossing over, Mutations and Chromosomal Aberrations, Plant Breeding, Methods of crop improvement, Inbreeding depression and Heterosis.</p> <p><b>CO2-</b> Understand and Learn about the important objectives of the plant breeding.</p> <p><b>CO3-</b> Illustrate the Knowledge about crossing-over, linkage, gene mapping methods, extra chromosomal inheritance and sex-linked inheritance, Methods of crop improvement.</p> <p><b>CO4-</b> Analyze the Mendelian principles, pedigree analysis and heredity traits and disorders.</p> <p><b>CO5-</b> Summarize the procedure, advantages and limitations of various crop improvement methods used for self-pollinated, cross pollinated and vegetatively propagated crops.</p> <p><b>CO6-</b> Generalize the knowledge of heredity and plant breeding.</p>
BBOL604	Lab Course	<p><b>CO1-</b> Recall Knowledge about Mendel's laws through seed ratios.</p> <p><b>CO2-</b> Express the understanding of Chromosome mapping using point test cross data.</p> <p><b>CO3-</b> Apply the Hybridization techniques - Emasculation, Bagging</p> <p><b>CO4-</b> Evaluate the problems of Incomplete dominance and gene interaction through seed ratios.</p> <p><b>CO5-</b> Conclude the knowledge of Mendel's laws.</p> <p><b>CO6-</b> Create the idea of polyploidy conditions in plants.</p>
BBOS605	Ethnobotany	<p><b>CO1-</b> Knowledge about history, concept, scope and relevance of herbal drugs in Indian system of medicine</p> <p><b>CO2-</b> Understand the techniques for drug evaluation (Chemical, Physical and Biological), Phytochemical investigations, standardization and quality control of herbal drugs</p> <p><b>CO3-</b> Apply the technique of medicinal gardening - Cultivation practices, marketing and utilization of selected medicinal plants</p> <p><b>CO4-</b> Analyze the macroscopic and microscopic characters, chemical constituents, adulterants, therapeutic and pharmaceutical uses of medicinal plants</p> <p><b>CO5-</b> Summarize the legal aspects of ethnobotanical studies</p> <p><b>CO6-</b> Collaborate ethnobotany to ethnic group.</p>
BBOS606	Biofertilizers	<p><b>CO1-</b> Remember the knowledge of classification, characteristics and culture maintenance of Rhizobium and Azotobacter, green manuring,</p>

		<p>organic fertilizers.</p> <p><b>CO2-</b> Understanding about the green manuring, organic fertilizers., characteristics and culture maintenance of Rhizobium and Azotobacter, Mycorrhizal association</p> <p><b>CO3-</b> Applying the knowledge about the role of Mycorrhizal associations in influencing the growth and yield of crop plants, isolation, identification, mass multiplication of Biofertilizers.</p> <p><b>CO4-</b> Analyze the General account about the microbes used as Biofertilizer.</p> <p><b>CO5-</b> Summarized the recycling of biodegradable waste materials, methods of making biocompost and vermicomposts.</p> <p><b>CO6-</b> Create the idea of making Biofertilizers.</p>
BBOS607	Soft skills for Employability enhance	<p><b>CO1-</b> Remember learning by themselves to improve thinking and effective time management skills through soft skills.</p> <p><b>CO2-</b> Understand professional communication situations and participate in such presentations with confidence</p> <p><b>CO3-</b> Apply assertion and change to adapt to corporate culture by being sensitive - personally and sensible professionally.</p> <p><b>CO4-</b> Analyse good professional exposure through the mini-live project</p> <p><b>CO5-</b> Evaluate negotiation and analytical skills</p> <p><b>CO6-</b> Design Strategies to enhance Emotional Intelligence</p>

## B.Sc. CHEMISTRY

### Program Specific Outcome (PSO)

<b>PSO1</b>	Chemistry graduates will become familiar with the fundamental concepts in organic, inorganic, physical and analytical chemistry.
<b>PSO2</b>	Chemistry graduates will develop analytical skills and acquire the ability to synthesize, separate and characterize compounds using laboratory techniques.
<b>PSO3</b>	Chemistry graduates will be able to understand the qualitative and quantitative chemical analysis of the compounds in the laboratory.
<b>PSO4</b>	Skill enhancement courses like chemistry of cosmetics & perfumes, pesticide and polymer chemistry will equip students with the knowledge and skills which will help them to make a successful career in the respective industries.

### Course Outcome (CO)

Course Code	Course Name	Outcome
<b>BCHC101</b>	<b>Atomic Structure, Bonding, General Organic Chemistry &amp; Aliphatic hydrocarbons</b>	<b>CO1</b> Gain knowledge of basics of atomic structure, chemical bonding, fundamentals of organic chemistry, stereochemistry and aliphatic hydrocarbons. <b>CO2</b> Understand fundamentals of organic chemistry, stereochemistry, atomic structure and bonding. <b>CO3</b> Illustrate VSEPR, MOT, preparation and reactions of aliphatic hydrocarbons. <b>CO4</b> Compare various types of reaction intermediates. <b>CO5</b> Predict the configurations of the organic compounds on the basis of stereochemistry. <b>CO6</b> Solve problems related to atomic structure and chemical bonding
<b>BCHL101</b>	<b>Lab Course Based on BCHC101</b>	<b>CO1</b> Gain knowledge about methodology used for detection of extra elements present in organic compounds. <b>CO2</b> Understand the concept of quantitative analysis of various inorganic compounds by means of titrations. <b>CO3</b> Apply the concept of paper chromatography for the separation of mixtures of amino acids and sugars <b>CO4</b> Analyze the results of titrations and paper chromatography. <b>CO5</b> Estimate the amount of oxalic acid by titrating it with $\text{KMnO}_4$ <b>CO6</b> Calculate retention factor values of amino acids and sugars separated by paper chromatography
<b>BCHC201</b>	<b>Chemical Energetics, Equilibria &amp; Functional</b>	<b>CO1</b> Gain knowledge about the basics of chemical energetics, chemical and ionic equilibria and

	<b>Group Organic Chemistry</b>	<p>various aromatic hydrocarbons, haloalkanes and oxygen containing functional groups</p> <p><b>CO2</b> Understand the preparations and properties of aromatic hydrocarbons, haloalkanes, haloarenes and oxygen containing functional groups.</p> <p><b>CO3</b> Explain various laws of thermodynamics, Le Chateliers principle, buffer solution, salt hydrolysis.</p> <p><b>CO4</b> Distinguish various types of nucleophilic substitution reactions.</p> <p><b>CO5</b> Justify the applications of laws of chemical energetics.</p> <p><b>CO6</b> Solve numerical problems related to chemical energetics, ionic and chemical equilibria</p>
<b>BCHL201</b>	<b>Lab Course Based on BCHC201</b>	<p><b>CO1</b> Gain knowledge about experiments related to thermochemistry.</p> <p><b>CO2</b> Understand the basic concept of pH and its measurement using pH meter.</p> <p><b>CO3</b> Apply the concepts of thermochemistry and pH-metry in performing practical's related to it.</p> <p><b>CO4</b> Analyze the results of experiments.</p> <p><b>CO5</b> Assess the mechanism involved in preparation of organic compounds.</p> <p><b>CO6</b> Synthesize oxygen containing organic compounds by using one step synthesis process</p>
<b>BCHC301</b>	<b>Solutions, Phase Equilibrium, Conductance, Electrochemistry &amp; Functional group Organic Chemistry</b>	<p><b>CO1</b> of Learn and gain knowledge about the concept of solutions, phase equilibrium, conductance, electrochemistry, carboxylic acids, amines, amino acids and carbohydrates</p> <p><b>CO2</b> Develop the basic understanding of solutions, phase equilibrium, conductance, electrochemistry, carboxylic acids, amines, amino acids and carbohydrates</p> <p><b>CO3</b> Illustrate Nernst distribution law, Gibbs Phase rule, Kohlrausch law, concentration cell, preparation and properties of amines, diazonium salts, carbohydrates, amino acids and carbohydrates</p> <p><b>CO4</b> Classify different types of solutions, proteins and carbohydrates &amp; calculate thermodynamic properties of cell.</p> <p><b>CO5</b> Distinguish amines, carbohydrates and proteins.</p> <p><b>CO6</b> Solve numerical problems related to conductance, electrochemistry and solutions</p>
<b>BCHL301</b>	<b>Lab Course Based on BCHC301</b>	<p><b>CO1</b> Gain knowledge about the basic practical's related to phase equilibria and conductance.</p> <p><b>CO2</b> Understand concepts involved in separation and titration of amino acids.</p> <p><b>CO3</b> Apply the concept of systematic qualitative</p>

		<p>analysis for the detection of functional groups in organic compounds.</p> <p><b>CO4</b> Differentiate reducing and non-reducing sugars.</p> <p><b>CO5</b> Test the action of salivary amylase on starch.</p> <p><b>CO6</b> Prepare curves for conductometric titrations of various acids and bases.</p>
<b>BCHS302</b>	<b>Pesticide Chemistry</b>	<p><b>CO1</b> Gain knowledge about pesticides</p> <p><b>CO2</b> Develop understanding of various types of pesticides.</p> <p><b>CO3</b> Learn about the applications of various synthetic classes of pesticides.</p> <p><b>CO4</b> Explain benefits, adverse effects and types of pesticides.</p> <p><b>CO5</b> Distinguish various types of pesticides.</p> <p><b>CO6</b> Write the synthesis and properties of pesticides</p>
<b>BCHC401</b>	<b>Coordination Chemistry, States of Matter &amp; Chemical Kinetics</b>	<p><b>CO1</b> Learn about transition elements, coordination chemistry, chemical kinetics, solids, liquids and kinetic theory of gases</p> <p><b>CO2</b> Understand the basic concepts of transition elements, kinetic theory of gases, coordination chemistry, solids, liquids and chemical kinetics</p> <p><b>CO3</b> Apply the concepts of chemical kinetics in deriving integrated rate equations and half-lives of first and second order reaction.</p> <p><b>CO4</b> Calculate CFSE of Oh and Td complexes, rate constants and half-lives of first and second order reaction</p> <p><b>CO5</b> Assess surface tension and viscosity of liquids using stalagmometer and Ostwald's viscometer.</p> <p><b>CO6</b> Solve numerical problems related to chemical kinetics, solids, liquids and kinetic theory of gases</p>
<b>BCHL401</b>	<b>Lab Course Based on BCHC401</b>	<p><b>CO1</b> Learn about transition elements, coordination chemistry, chemical kinetics, solids, liquids and kinetic theory of gases</p> <p><b>CO2</b> Understand the basic concepts of transition elements, kinetic theory of gases, coordination chemistry, solids, liquids and chemical kinetics</p> <p><b>CO3</b> Apply the concepts of chemical kinetics in deriving integrated rate equations and half-lives of first and second order reaction.</p> <p><b>CO4</b> Calculate CFSE of Oh and Td complexes, rate constants and half-lives of first and second order reaction</p> <p><b>CO5</b> Assess surface tension and viscosity of liquids using stalagmometer and Ostwald's viscometer.</p>

		<b>CO6</b>	Solve numerical problems related to chemical kinetics, solids, liquids and kinetic theory of gases
<b>BCHS402</b>	<b>Chemistry of Cosmetics &amp; Perfumes</b>	<b>CO1</b> <b>CO2</b> <b>CO3</b> <b>CO4</b> <b>CO5</b> <b>CO6</b>	Gain knowledge about the preparations of various important cosmetic products. Develop understanding of uses of various cosmetic products in daily life. Explain the importance of essential oils in cosmetic industries. Explain the synthesis and uses of various cosmetic products. Assess the characteristics of various cosmetic products. Express the constituents of different cosmetic products
<b>BCHD501</b>	<b>Analytical Methods in Chemistry</b>	<b>CO1</b> <b>CO2</b> <b>CO3</b> <b>CO4</b> <b>CO5</b> <b>CO6</b>	Learn and gain knowledge about quantitative and qualitative analysis. Understand basics of spectroscopic, thermal and electroanalytical techniques. Illustrate different separation techniques. Explain errors, sampling, chromatography solvent extraction and spectroscopy. Summarize different terms used in spectroscopic and separation techniques. Express the applications of different spectroscopic and separation techniques..
<b>BCHL501</b>	<b>Lab Course Based on BCHD501</b>	<b>CO1</b> <b>CO2</b> <b>CO3</b> <b>CO4</b> <b>CO5</b> <b>CO6</b>	Remember the basics of chemistry practical's and lab rules. Understand separation of ions, sugars and pigments by chromatography. Apply solvent extraction technique for determination of Nickel. Analyze PH of different shampoo solutions. Measure BOD, COD, DO and other parameters the obtained results Solve the experimental data.
<b>BCHD503</b>	<b>Green Chemistry</b>	<b>CO1</b> <b>CO2</b> <b>CO3</b> <b>CO4</b> <b>CO5</b> <b>CO6</b>	Gain knowledge about green chemistry, its need, limitations and future prospects of it. Understand the principle and future trends of green chemistry. Apply the principles of green chemistry to some real-world examples. Analyze the concept of green chemistry. Assess the role of green chemistry in sustainable development. Design the green synthetic routes by applying 12 principles of green chemistry for preparation of compounds
<b>BCHL503</b>	<b>Lab Course Based on BCHD503</b>	<b>CO1</b> <b>CO2</b>	Describe the preparation of biodiesel from vegetable/ waste cooking oil. Explain the condensation of benzene by using



		<p>biocatalyst.</p> <p><b>CO3</b> Illustrate solvent free alternative methods of reactions/synthesis.</p> <p><b>CO4</b> Deduce experiments based on the concept of green chemistry.</p> <p><b>CO5</b> Assess the use of enzymes as catalysts in organic reactions.</p> <p><b>CO6</b> Synthesize and characterize gold nanoparticles from tea leaves</p>
<b>BCHD505</b>	<b>Industrial Chemicals and Environment</b>	<p><b>CO1</b> Gain knowledge about the different toxic gases, their toxicity hazards and types of pollution.</p> <p><b>CO2</b> Explain composition of air, air pollutants, effects and preventive measures for controlling air pollution.</p> <p><b>CO3</b> Illustrate about various sources of water, its quality parameters, impact and treatment of water pollution</p> <p><b>CO4</b> Distinguish various types of pollutants and pollution.</p> <p><b>CO5</b> Assess the impact of air pollution on the environment.</p> <p><b>CO6</b> Formulate various measures to control air, water and noise pollution</p>
<b>BCHL505</b>	<b>Lab Course Based on BCHD505</b>	<p><b>CO1</b> Gain knowledge of physical parameters of water by titration methods.</p> <p><b>CO2</b> Determine percentage of chlorine in bleaching powder.</p> <p><b>CO3</b> Apply UV-Vis spectroscopy to determine concentration of Cr (VI) in waste water sample.</p> <p><b>CO4</b> Analyze the UV-Vis spectra.</p> <p><b>CO5</b> Evaluate DO, COD and BOD of water samples.</p> <p><b>CO6</b> Report the amount of chloride, sulphate and salinity in water samples by simple titration method</p>
<b>BCHS504</b>	<b>Polymer Chemistry</b>	<p><b>CO1</b> Gain knowledge basics of polymer chemistry.</p> <p><b>CO2</b> Understand polymers, their structure and applications in various fields.</p> <p><b>CO3</b> Explain the physical properties of polymeric solutions.</p> <p><b>CO4</b> Illustrate preparation, structure, properties and applications of selective important polymers.</p> <p><b>CO5</b> Evaluate the thermodynamic parameters related to polymeric chemistry.</p> <p><b>CO6</b> Produce the mechanism of kinetics of polymerization</p>
<b>BCHD601</b>	<b>Spectroscopic Methods Of Chemical Analysis</b>	<p><b>CO1</b> Gain knowledge of basic components of IR, FTIR, UV-Visible, Mass and NMR spectroscopy.</p> <p><b>CO2</b> Interpret IR, FTIR and UV-visible spectra.</p>

		<p><b>CO3</b> Apply the concepts of UV-Vis, FTIR and NMR spectroscopy in explaining the spectra.</p> <p><b>CO4</b> Analyze various FTIR, NMR and Mass spectra.</p> <p><b>CO5</b> Distinguish between various spectroscopic methods of analysis.</p> <p><b>CO6</b> Solve problems related to UV-Vis, NMR, FTIR and mass spectrometry</p>
<b>BCHL601</b>	<b>Lab Course Based on BCHD601</b>	<p><b>CO1</b> Gain knowledge about the statistical analysis of data.</p> <p><b>CO2</b> Interpret IR and UV-Vis spectra of organic compounds.</p> <p><b>CO3</b> Apply the concept of Mass and NMR spectroscopy to elucidate the structure of organic compounds.</p> <p><b>CO4</b> Analyze the IR, mass and NMR spectra of organic compounds.</p> <p><b>CO5</b> Assess isoelectric pH of protein samples.</p> <p><b>CO6</b> Develop titration curve of amino acids.</p>
<b>BCHD602</b>	<b>Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy</b>	<p><b>CO1</b> Gain basic knowledge of transition elements, organometallics, bio-inorganic, polynuclear chemistry and spectroscopic techniques.</p> <p><b>CO2</b> Develop basic understanding of chemistry of organometallic and bio inorganic compounds.</p> <p><b>CO3</b> Explain preparation and uses of polynuclear and active methylene compounds.</p> <p><b>CO4</b> Analyze UV-VIS and IR spectra</p> <p><b>CO5</b> Predict the structure of organic compounds on the basis of UV and IR spectroscopy</p> <p><b>CO6</b> Justify the role of metal ions in biological processes.</p>
<b>BCHL602</b>	<b>Lab Course Based on BCHD602</b>	<p><b>CO1</b> Gain knowledge of principle of paper and thin layer chromatography.</p> <p><b>CO2</b> Understand preparation of complexes and their conductivity measurement.</p> <p><b>CO3</b> Illustrate qualitative analysis of organic compounds having different functional groups.</p> <p><b>CO4</b> Explain the difference in retention factor values obtained in the experiment for separation of ions by paper chromatography.</p> <p><b>CO5</b> Assess retention factor values of various inorganic ions separated by paper and thin layer chromatography.</p> <p><b>CO6</b> Prepare one of the derivatives of organic compounds possessing monofunctional group (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines)</p>
<b>BCHD603</b>	<b>Molecules of Life</b>	<p><b>CO1</b> Learn and gain knowledge of molecules of life.</p> <p><b>CO2</b> Understand the classifications and other details of carbohydrates, enzymes, lipids etc.</p>

		<p><b>CO3</b> Illustrate the concept of lipids, proteins, nucleic acids etc.</p> <p><b>CO4</b> Explain carbohydrates, enzymes, proteins, lipids nucleic acids etc</p> <p><b>CO5</b> Summarize the concept of different biomolecules.</p> <p><b>CO6</b> Express the details of energy in biosystem.</p>
<b>BCHL603</b>	<b>Lab Course Based on BCHD603</b>	<p><b>CO1</b> Gain knowledge of separation and titrations of amino acids.</p> <p><b>CO2</b> Understand saponification and iodine value of oil/fats.</p> <p><b>CO3</b> Examine the action of salivary amylase on starch.</p> <p><b>CO4</b> Differentiate between reducing and non-reducing sugar.</p> <p><b>CO5</b> Evaluate and interpret the obtained results</p> <p><b>CO6</b> Synthesize organic compounds</p>
<b>BCHS605</b>	<b>Chemistry of Soil, Water and Food</b>	<p><b>CO1</b> Gain knowledge about basic composition of soil and water.</p> <p><b>CO2</b> Describe about the nutritional value of food, processing of food and adulteration of food</p> <p><b>CO3</b> Explain physical, chemical and biological parameters of soil.</p> <p><b>CO4</b> Analyze physical, chemical and biological parameters of water</p> <p><b>CO5</b> Evaluate pH of soil and water samples</p> <p><b>CO6</b> Test the quality of soil, water and food samples</p>

## B.Sc. Physics

### Program Specific Outcome (PSOs)

On Successful completion of the B.Sc. Program, students will able to:

<b>PSO 1</b>	To develop practical, analytical and mathematical skills in physics
<b>PSO2</b>	To demonstrate knowledge of various fields such as electricity, properties of matter, optics, electronics, modern physics, and to analyze complex physical phenomena.
<b>PSO3</b>	To learn Physics laboratory skills and analyze the measurements to draw valid conclusions.
<b>PSO4</b>	To develop academic and scientific abilities, personal qualities and transferable skills in students to make them responsible citizen.

Course Code	Course Name	Outcome
<b>BPHC101</b>	<b>Mechanics</b>	<p><b>CO1</b> Visualize vector calculus and describe laws of motion, rotational motion, gravitation, special theory of relativity, fluids and elasticity.</p> <p><b>CO2</b> Develop a basic understanding of scalar and vector products conservation laws, motions of rockets, special theory of relativity, surface tension viscosity, elastic constants.</p> <p><b>CO3</b> Explain length contraction, time dilation, GPS, stoke's law Poiseuille's formula, Hooke's law and apply these in various problems</p> <p><b>CO4</b> Classify and differentiate elastic constant, angular velocity and linear velocity, frame of reference</p> <p><b>CO5</b> Evaluate the modulus of rigidity by torsional pendulum, work done in stretching and twisting the wire</p> <p><b>CO6</b> Solve the problems of vectors and differential equation Poisson's ratio, viscosity, surface tension.</p>
<b>BPHL101</b>	<b>Lab. Course based on BPHC101</b>	<p><b>CO1</b> Learn and gain knowledge about viscosity, moment of inertia, elastic constants ,motion of spring, acceleration due to gravity.</p> <p><b>CO2</b> Understand about measurement tools, Bar Pendulum, kater's pendulum, flywheel, Maxwell needle, inertia table, barton's apparatus</p> <p><b>CO3</b> Apply the principle of viscosity, gravity, elasticity on instruments</p> <p><b>CO4</b> Analyse the motion of spring, pendulums, inertia table and then</p>

		<p>calculate the value of spring constant, elastic constants and acceleration due to gravity.</p> <p><b>CO5</b> Evaluate the value of elastic constants, coefficient of viscosity, acceleration due to gravity, diameter, radius, and length of various bodies</p> <p><b>CO6</b> Formulate the results of elastic constants, acceleration due to gravity, diameter and length of various bodies</p>
<b>BPHC201</b>	<b>Electricity and Magnetism</b>	<p><b>CO1</b> Describe vector analysis, electrostatics, magnetism, electromagnetic induction, Maxwell's equations and Electromagnetic wave propagation</p> <p><b>CO2</b> Understand about Gauss's divergence theorem, Stoke's theorem, Gauss theorem and its applications, Maxwell's equation, equation of continuity, Polarisation,</p> <p><b>CO3</b> Explain and distinguish between dia-, para-, and ferromagnetic material. Apply Biot-Savart's law, Ampere's circuital law in various systems</p> <p><b>CO4</b> Analyse gradient, divergence and curl, electric flux, poynting vector, displacement current, Parallel plate, spherical and cylindrical condenser.</p> <p><b>CO5</b> Evaluate and assess Faraday's laws of electromagnetic induction, Gauss's theorem in dielectrics</p> <p><b>CO6</b> Solve the problems based on electric field, electric potential, magnetism , dielectrics and electromagnetic wave propagation.</p>
<b>BPHL201</b>	<b>Lab. Course based on BPHC201</b>	<p><b>CO1</b> Observe multimeter measurements of resistance, voltage, and current and gain knowledge about Carey Foster's Bridge, LCR Circuit</p> <p><b>CO2</b> Understand about various circuits such as LC, RC and LCR circuits, De'Sauty's bridge.</p> <p><b>CO3</b> Apply Superposition, Thevenin, Norton and Maximum Power Transfer theorems in various systems.</p> <p><b>CO4</b> Analyse the high resistance by Leakage Method,</p> <p><b>CO5</b> Estimate the values of voltage, current, resistance by multimeter, Self Inductance of a Coil by Rayleigh's Method, Characteristics of as LC, RC and LCR circuits</p> <p><b>CO6</b> Formulate the results of various network theorems, LCR circuit, Carey</p>

		Foster's Bridge.
<b>BPHC301</b>	<b>Thermal Physics and Statistical Mechanics</b>	<p><b>CO1</b> Describe laws of thermodynamics, thermodynamic potentials, kinetic theory of gases, theory of radiations, and statistical mechanics</p> <p><b>CO2</b> Understand about Maxwell's thermodynamic relations, Planck's radiation law, Carnot's cycle, M-B, B-E, F-D Statistics, Stefan's law,</p> <p><b>CO3</b> Explain Joule-Thompson Effect, Clausius- Clapeyron Equation, TdS equations, Mayer's formula, ensembles, Phase space, Wien's displacement law, Law of equipartition of energy and its applications to specific heat of gases</p> <p><b>CO4</b> Analyze about Transport Phenomena, kinetic theory of gases, various laws of thermodynamics, Carnot's theorem</p> <p><b>CO5</b> Estimate Work Done during Isothermal and Adiabatic Processes and compare M-B, B-E, F-D Statistics</p> <p><b>CO6</b> Write the characteristics of black body radiation, various thermodynamic Processes, Entropy, Reversible &amp; irreversible processes</p>
<b>BPHL301</b>	<b>Lab. Course based on BPHC301</b>	<p><b>CO1</b> Learn and Gain knowledge of measurement heat flow, black body radiation, Stefan's Constant, thermal conductivity</p> <p><b>CO2</b> Understand about thermal conductivity of copper by Searle's and Angstrom's apparatus Platinum resistance thermometer</p> <p><b>CO3</b> Apply and calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge,</p> <p><b>CO4</b> Analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system and variation of thermo emf across two junctions of a thermocouple with temperature</p> <p><b>CO5</b> Evaluate the value of stefan's constant, Planck constant, temperature co-efficient of resistance by Stefan's, instrument, black body radiation, Platinum resistance thermometer respectively</p> <p><b>CO6</b> Formulate the results of Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method, the coefficient of thermal conductivity of a</p>

		bad conductor by Lee and Charlton's disc method.
<b>BPHC401</b>	<b>Waves and Optics</b>	<p><b>CO1</b> Define and describe Oscillations, Superposition Principle and Sound, optics, interference, Diffraction and Polarization.</p> <p><b>CO2</b> Understand about the concept of SHM, Newton's rings, Sabine's formula, polarization, Interference by division of amplitude and division of wavefront and Fresnel and Fraunhofer diffraction.</p> <p><b>CO3</b> Apply standing waves, zone plate, Lissajous figures, Michelson's Interferometer.</p> <p><b>CO4</b> Analyse about the Fresnel and Fraunhofer diffraction, Fourier's Theorem, Acoustics of buildings, Huygen's principle, Interference in Thin Films, damped oscillations, forced vibrations and resonance, Lissajous figures.</p> <p><b>CO5</b> Evaluate the production of Plane polarized light, Circular and elliptical polarized light, Group velocity, Phase velocity, Group velocity, Phase velocity, principle of superposition of waves</p> <p><b>CO6</b> Formulate the Characteristics of Diffraction grating, Newton's Rings, Half-period zones, single slit, double slit</p>
<b>BPHL401</b>	<b>Lab. Course based on BPHC401</b>	<p><b>CO1</b> Describe about the motion of coupled oscillators and observe the wavelength of Laser light using Diffraction of Single Slit</p> <p><b>CO2</b> Observe the Height of a Building using a Sextant, the intensity using photo sensor and laser in diffraction patterns of single and double slits</p> <p><b>CO3</b> Determine the wavelength of sodium light using Fresnel Biprism and Newton's ring, Resolving Power of a Prism, value of Cauchy Constants of a material of a prism</p> <p><b>CO4</b> Analyse the wavelength of Mercury light using plane diffraction Grating</p> <p><b>CO5</b> Evaluate Dispersive Power of the Material of a given Prism using Mercury Light, Refractive Index of the Material of a given Prism using Sodium Light</p> <p><b>CO6</b> Formulate the Frequency of an</p>

			Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda^2 \propto T$ Law and Familiarization with Schuster's focusing, determination of angle of prism
<b>BPHD501</b>	<b>Elements of Modern Physics</b>	<p><b>CO1</b> Visualize quantum Mechanics and Bohr Atom Model, Quantum Systems and Heisenberg Uncertainty Principle, Matter Waves and Schrödinger Equation, Motion in a Potential Well, Radioactivity, Fission and fusion.</p> <p><b>CO2</b> Understanding Radioactivity: stability of nucleus; Law of radioactive decay, De Broglie wavelength and matter waves; Davisson-Germer experiment, Bohr's model, nuclear forces, liquid drop model</p> <p><b>CO3</b> Apply Compton scattering, semi-empirical mass formula and binding energy, packing fraction, expectation value, Mean life &amp; half-life; One dimensional infinitely rigid box-energy eigenvalues and eigen functions.</p> <p><b>CO4</b> Analyze <math>\alpha</math> decay; <math>\beta</math> decay, <math>\gamma</math> decay, Fission and fusion, Nuclear reactor, Planck's constant, Photoelectric effect, binding energy, packing fraction, expectation value, wave function</p> <p><b>CO5</b> Evaluate Schrodinger equation, Heisenberg uncertainty principle, laws of photoelectric emission, Rutherford model, Bohr's model, quantization rule and atomic stability.</p> <p><b>CO6</b> Solve Probability and probability current densities in one-dimension, binding energy, Mean life &amp; half-life; calculation of energy levels for hydrogen like atoms and their spectra.</p>	
<b>BPHL501</b>	<b>Lab. Course based on BPHD501</b>	<p><b>CO1</b> Learn and gain knowledge of PN diode, vacuum Diode, diffraction patterns, LEDs</p> <p><b>CO2</b> Understand about work function of material of filament of directly heated vacuum Diode, value of Boltzmann constant using V-I characteristic of PN diode, absorption lines in the rotational spectrum of Iodine vapor.</p> <p><b>CO3</b> Apply the Photo-electric effect and calculate photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light</p> <p><b>CO4</b> Analyze Millikan oil drop apparatus</p>	



		<p>and determine the charge of an electron, the absorption lines in the rotational spectrum of Iodine vapor</p> <p><b>CO5</b> Evaluate the value of <math>e/m</math> by magnetic focusing, the wavelength of H-alpha emission line of Hydrogen atom, value of Planck's constant using LEDs of at least 4 different colours</p> <p><b>CO6</b> Formulate the results of diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light</p>
<b>BPHD502</b>	<b>Mathematical Physics</b>	<p><b>CO1</b> Visualize Calculus of functions of more than one variable, Fourier Series, Frobenius Method and Special Functions, Some Special Integrals, Partial Differential Equations, Complex Analysis</p> <p><b>CO2</b> Understanding Beta and Gamma Functions and Relation between them, Properties of Legendre Polynomials</p> <p><b>CO3</b> Apply Cauchy's Integral formula, Euler's formula, De Moivre's theorem, Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry, Rodrigues Formula, Frobenius method</p> <p><b>CO4</b> Analyze Beta and Gamma Functions and Relation between them, Properties of Legendre Polynomials, Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions, Expression of Integrals in terms of Gamma Functions. Error Function.</p> <p><b>CO5</b> Evaluate Constrained Maximization using Lagrange Multipliers, Expansion of non-periodic functions over an interval, Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable</p> <p><b>CO6</b> Solve Euler's formula, De Moivre's theorem, Roots of Complex Numbers, . Legendre, Bessel, Hermite and Laguerre Differential Equations, Cauchy's Inequality. Cauchy's Integral formula.</p>
<b>BPHL502</b>	<b>Lab. Course based on BPHD502</b>	<p><b>CO1</b> Learn and Gain knowledge of Basics of scientific computing, Errors and error Analysis, C &amp; C++ Programming fundamentals, Random number</p>

		<p>generation, Interpolation methods, Error estimation of linear interpolation, Numerical differentiation, and Integration</p> <p><b>CO2</b> Understand about Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods, Random number generation, Interpolation methods, Error estimation of linear interpolation, Numerical differentiation, and Integration</p> <p><b>CO3</b> Apply Bisection, Newton Raphson and Secant methods, Random number generation, Interpolation methods, Error estimation of linear interpolation, Numerical differentiation, and Integration in various problems</p> <p><b>CO4</b> Analyse Basics of scientific computing, Errors and error Analysis, C &amp; C++ Programming fundamentals, Random number generation, Interpolation methods, Error estimation of linear interpolation, Numerical differentiation, and Integration</p> <p><b>CO5</b> Evaluate about Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods, Random number generation, Interpolation methods, Error estimation of linear interpolation, Numerical differentiation, and Integration, C &amp; C++ Programming</p> <p><b>CO6</b> Formulate the solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods, Random number generation, Interpolation methods, C &amp; C++ Programming Error estimation of linear interpolation, Numerical differentiation, and Integration</p>
<b>BPHD601</b>	<b>Solid State Physics</b>	<p><b>CO1</b> Visualize Crystal Structure, Elementary Lattice Dynamics, Magnetic Properties of Matter, Dielectric Properties of Materials, Elementary band theory, superconductivity</p> <p><b>CO2</b> Understanding Type I and type II Superconductors, London's Equation, Langevin-Debye equation, Brillouin Zones, Langevin Theory of dia – and</p>

		<p>Paramagnetic Domains, Discussion of B-H Curve. Hysteresis and Energy Loss.</p> <p><b>CO3</b> Apply Unit Cell. Miller Indices. Reciprocal Lattice, Dia-, Para-, Ferri- and Ferromagnetic Materials, Einstein and Debye theories of specific heat of solids. T3law,</p> <p><b>CO4</b> Analyze Types of Lattices, Acoustical and Optical Phonons, P and N type Semiconductors. Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient, Normal and Anomalous Dispersion, Diffraction of X-rays by Crystals. Bragg's Law.</p> <p><b>CO5</b> Evaluate Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. B-H Curve. Hysteresis and Energy Loss, Isotope effect, Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors.</p> <p><b>CO6</b> Solve Unit Cell. Miller Indices. Reciprocal Lattice, Atomic and Geometrical Factor, Susceptibility. Polarizability. Clausius Mossotti Equation, Langevin-Debye equation, Complex Dielectric Constant.</p>
<b>BPHL601</b>	<b>Lab. Course based on BPHD601</b>	<p><b>CO1</b> Learn and Gain knowledge of Magnetic susceptibility, Ferroelectric Crystals, Dielectric Constant, semiconductors, magnetic materials</p> <p><b>CO2</b> Understand the concept and measure the Magnetic susceptibility of Solids, the resistivity of a semiconductor (Ge) crystal with temperature by four probe method</p> <p><b>CO3</b> Apply the principle and calculate the Coupling Coefficient of a Piezoelectric crystal, the Hall coefficient of a semiconductor sample</p> <p><b>CO4</b> Analyze and measure the Dielectric Constant of a dielectric Materials with frequency, the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance</p> <p><b>CO5</b> Evaluate the refractive index of a dielectric layer using SPR, susceptibility of paramagnetic solution, Hysteresis loop of a Ferroelectric Crystal</p> <p><b>CO6</b> Formulate and draw the BH curve of</p>

		iron using a Solenoid and determine the energy loss from Hysteresis
<b>BPHD602</b>	<b>Quantum Mechanics</b>	<p><b>CO1</b> Visualize time dependent and independent Schrodinger equation, bound states in an arbitrary potential, Quantum theory of hydrogen-like atoms, Atoms in Electric and Magnetic Fields, Many electron atoms.</p> <p><b>CO2</b> Understanding Spin-orbit coupling in atoms-L-S and J-J couplings Time dependent Schrodinger equation and independent equation, Time independent Schrodinger equation in spherical polar coordinates, Stern-Gerlach Experiment.</p> <p><b>CO3</b> Apply Normal and Anomalous Zeeman Effect, Pauli's Exclusion Principle, application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigen functions.</p> <p><b>CO4</b> Analyze Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions, Spectral Notations for Atomic States. Total Angular Momentum. Vector Model, Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem.</p> <p><b>CO5</b> Evaluate uncertainty principle, Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions, application of barrier tunneling.</p> <p><b>CO6</b> Solve commutation relation, angular momentum operator and quantum numbers; Radial wave functions, Position, momentum &amp; Energy operators; commutator of position and momentum operators; Expectation values</p>
<b>BPHL602</b>	<b>Lab. Course based on BPHD602</b>	<p><b>CO1</b> Define and describe the problems based on quantum mechanics, Electron spin resonance, Zeeman effect, quantum tunneling effect, tunnel diode</p> <p><b>CO2</b> Gain understanding of solving the Schrodinger problems based on quantum mechanics, Zeeman effect, tunnel diode, electron spin resonance</p> <p><b>CO3</b> Apply quantum tunnelling effect with</p>

		<p>solid state device, Schrodinger equation to quantum problems,</p> <p><b>CO4</b> Analyse the exposure of Zeeman effect with an external magnetic field; Hyperfine splitting, Schrodinger equation for various problems.</p> <p><b>CO5</b> Evaluate the solutions of Schrodinger equation, Zeeman effect problems, Electron spin resonance</p> <p><b>CO6</b> Formulate the results of quantum tunnelling effect, Zeeman effect, Schrodinger equation problems, electron spin response.</p>
<b>BPHS302</b>	<b>Computational Physics</b>	<p><b>CO1</b> Define and describe Algorithms and Flowcharts, Scientific Programming, Scientific word processing, Visualization, Equation representation.</p> <p><b>CO2</b> Understand about the FORTRAN, Algorithms and Flowcharts, LaTeX word processor, Gnuplot.</p> <p><b>CO3</b> Apply Gnuplot, FORTRAN, LaTeX, flowchart in programming</p> <p><b>CO4</b> Analyse <math>\sin(x)</math> as a series, Operators, Expressions, Euler number</p> <p><b>CO5</b> Evaluate the results of scientific programming, FORTRAN, Algorithms and Flowcharts, LaTeX word processor, Gnuplot programming.</p> <p><b>CO6</b> Formulate the expressions of Algorithms and Flowcharts, Scientific Programming, Scientific word processing, Visualization, Equation representation in various problems.</p>
<b>BPHS402</b>	<b>Radiation Safety</b>	<p><b>CO1</b> Define and describe Basics of Atomic and Nuclear Physics, Interaction of Radiation with matter, Interaction of Charged Particles, Interaction of Charged Particles, Radiation detection and monitoring devices Radiation safety management</p> <p><b>CO2</b> Understand about the concepts of Atomic and Nuclear Physics, Interaction of Radiation with matter, Interaction of Charged Particles, Interaction of Charged Particles, Radiation Quantities and Units, Radiation detection Radiation safety management</p> <p><b>CO3</b> Apply nuclear techniques, radiation detection methods, radiation safety management in various problems.</p> <p><b>CO4</b> Analyse radiation safety measures, radiation detection methods,</p>

		<p>interaction of charged particles, Interaction of Radiation with matter.</p> <p><b>CO5</b> Evaluate the working of gas detectors, ICRP, nuclear techniques</p> <p><b>CO6</b> Write the characteristics of basics of atomic and nuclear Physics, Radiation Quantities and Units</p>
<b>BPHS503</b>	<b>Electronics –I (Network Theorems, Solid state Devices, Rectifiers</b>	<p><b>CO1</b> Visualize network analysis and Network Theorem, Solid State Devices, Rectifiers and Filters.</p> <p><b>CO2</b> Understanding network Theorems, CRO, VTVM, Diode, Triode, Tetrode, Pentode and their characteristics, Transistors, common emitter, common base and common collector configurations, current amplification.</p> <p><b>CO3</b> Apply HW, FW rectifiers, , Low pass and High pass filters, Binary ,Decimal, Hexadecimal and Octal number systems and interconversions.</p> <p><b>CO4</b> Analyze logic gate and Boolean algebra, Kirchhoff's Law, Series parallel corrections, intrinsic and extrinsic n-type and p-type semiconductors, P-N junction, Semiconductor junction diode</p> <p><b>CO5</b> Evaluate Four terminal Network, Zener, Varactor, Tunnel diode , Photodiode, Light emitting diode, Junction, P-N junction.</p> <p><b>CO6</b> Solve Binary ,Decimal, Hexadecimal and Octal number systems and interconversions, Low pass and High pass filters</p>
<b>BPHS603</b>	<b>Electronics-II (Amplifiers and oscillators)</b>	<p><b>CO1</b> Define and describe transistor amplifier, feedback amplifiers and oscillators</p> <p><b>CO2</b> Understand about power amplifiers, feedback amplifiers R.C coupled, Impedance coupled and Transformer coupled amplifiers, multivibrators</p> <p><b>CO3</b> Explain the working of crystal oscillator, positive feedback oscillators, negative resistance oscillators and various transistor amplifiers</p> <p><b>CO4</b> Analyse the working of FET amplifier, relaxation oscillators, Single stage transistor amplifier, Noise and distortion in amplifiers</p> <p><b>CO5</b> Evaluate the applications of various oscillators, transistor amplifier, power amplifiers and feedback amplifiers</p> <p><b>CO6</b> Write the Classification of Basic</p>

		<p>Amplifier, characteristics of Load Line, Transistor biasing, Transistor equivalent circuit.</p>
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## B.Sc. MATHEMATICS

### Program Specific Outcome (PSO)

<b>PSO-1</b>	Graduates will acquire a comprehensive knowledge and sound understanding of fundamentals of Mathematics.
<b>PSO-2</b>	Graduates will develop numerical, analytical and mathematical skills.
<b>PSO-3</b>	Graduates will be prepared to Acquiring a range of general skills, solve problems, Evaluating information using computers productively to communicate with the society effectively and its allied areas in multiple disciplines concerned with mathematics.
<b>PSO-4</b>	Graduates will acquire a job efficiently in diverse fields such as Science and Engineering, Education, Banking, Public Services, Business etc.

### Course Outcome (CO)

Course Code	Course Name	Outcome
<b>BMTC-101</b>	<b>Differential Calculus</b>	<b>CO1</b> Identify the notions of limit of a sequence and convergence of a series of real numbers. <b>CO2</b> Interpret tracing of curves, different theorem-based questions. <b>CO3</b> Examine successive differentiation by Leibnitz theorem, Indeterminate forms. <b>CO4</b> Evaluate Limit and Continuity, Tangents and normal, Indeterminate forms. <b>CO5</b> Distinguish Curvature, Asymptotes, Singular points, Tracing of curves. <b>CO6</b> Solve limit, normal, singular points, maxima minima.
<b>BMTC-201</b>	<b>Differential Equations</b>	<b>CO1 -</b> Describe various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order <b>CO2 -</b> Understand the genesis of ordinary differential equations. <b>CO3 -</b> Apply the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations. <b>CO4 -</b> Classify mathematical models in the form of ordinary differential equations to suggest possible solutions of the day to day problems arising in physical, chemical and biological disciplines. <b>CO5-</b> Evaluate differential equation of first order, Linear homogenous equations. <b>CO6-</b> Solve Charpit's method based questions, Simultaneous differential equations.
<b>BMTC-301</b>	<b>Real Analysis</b>	<b>CO1 -</b> Identify bounded, convergent, divergent, Cauchy and monotonic sequences and to



		<p>calculate their limit superior, limit inferior, and the limit of a bounded sequence.</p> <p><b>CO2</b> - Understand many properties of the real line <math>\mathbb{R}</math> and learn to define sequence in terms of functions from <math>\mathbb{R}</math> to a subset of <math>\mathbb{R}</math>.</p> <p><b>CO3</b> - Apply the ratio, root and alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.</p> <p><b>CO4</b> - Classify some of the properties of Riemann integral functions and the applications of the fundamental theorems of integration.</p> <p><b>CO5</b> - Test the convergence of the infinite series by Ratio test, P test, Root test etc.</p> <p><b>CO6</b> - Solve the questions based on <math>M</math>, <math>M_n</math> test and Leibnitz test etc.</p>
<b>BMTS-302</b>	<b>Logic and Sets</b>	<p><b>CO1</b> Knowledge of fundamental theorem of algebra.</p> <p><b>CO2</b> Understand the different types of matrices.</p> <p><b>CO3</b> Apply to solve the problems regarding matrices.</p> <p><b>CO4</b> Distinguish exponential, logarithmic, circular and hyperbolic functions.</p> <p><b>CO5</b> Evaluate the questions based on matrices, numbers etc.</p> <p><b>CO6</b> Solve the matrices, Exponential, Logarithmic, Circular and hyperbolic functions etc.</p>
	<b>Analytical Geometry</b>	<p><b>CO1</b> Gain knowledge of sketching different surfaces like parabola, ellipse etc.</p> <p><b>CO2</b> Understand the quadratic equations representing lines etc.</p> <p><b>CO3</b> Illustrate the graphing standard quadric surfaces like cone ellipsoid etc.</p> <p><b>CO4</b> Distinguish the properties of various surfaces.</p> <p><b>CO5</b> Evaluate the General equation of second degree, Central coincides, Tangent plane, Director sphere, Normal etc.</p> <p><b>CO6</b> Write the techniques for sketching parabola, graphing standard quadric surfaces like cone, ellipsoid etc.</p>
<b>BMTS-304</b>	<b>Integral Calculus</b>	<p><b>CO1</b> Knowledge to integrate of rational and irrational functions.</p> <p><b>CO2</b> Understand the trigonometric exponential and logarithmic functions and their combinations.</p> <p><b>CO3</b> Solve the problems regarding areas and volumes of surfaces of solids.</p> <p><b>CO4</b> Distinguish the properties of definite integrals.</p> <p><b>CO5</b> Evaluate Areas and lengths of curves in</p>

		<p>the plane, Double and Triple integrals, integration of rational and irrational functions etc.</p> <p><b>CO6</b> Integrate by Partial fractions, Solve definite integrals etc.</p>
<b>BMTC-401</b>	<b>Algebra</b>	<p><b>CO1</b> Definition of groups, subgroups, cyclic subgroups and rings.</p> <p><b>CO2</b> Understand the theorems and problems regarding groups and rings etc.</p> <p><b>CO3</b> Apply the properties of groups and rings to solve the problems.</p> <p><b>CO4</b> Distinguish various problems regarding fields, integral domain, ideals.</p> <p><b>CO5</b> Evaluate Cyclic groups from number systems, complex roots of unity, circle group, Subrings and ideals, Integral domains and fields, examples of fields: <math>\mathbb{Z}_p</math>, <math>\mathbb{Q}</math>, <math>\mathbb{R}</math>, and <math>\mathbb{C}</math> etc.</p> <p><b>CO6</b> Solve the commutator subgroup of group, examples of center of a group etc.</p>
<b>BMTS-402</b>	<b>Vector Calculus</b>	<p><b>CO1</b> - Knowledge of Scalar and vector function.</p> <p><b>CO2</b> Understand the differentiation and integration of vector functions.</p> <p><b>CO3</b> Apply the vector identities in Green's theorem etc.</p> <p><b>CO4</b> - Distinguish the vector identities in applying dot and cross product questions.</p> <p><b>CO5</b> - Evaluate Vector identities, Gradient, divergence and curl in given equations.</p> <p><b>CO6</b> - Solve the equations of partial differentiation of a vector function, vector integration along line etc.</p>
<b>BMTS-403</b>	<b>Theory of Equations</b>	<p><b>CO1</b> - Describe the general properties of polynomials, equations and Symmetric functions.</p> <p><b>CO2</b> - Understand the relations between the roots and the coefficient of equations.</p> <p><b>CO3</b> - Apply the relations in solutions of reciprocal and binomial equations.</p> <p><b>CO4</b> - Compare the properties of derived, symmetric functions etc.</p> <p><b>CO5</b> - Summarize the general properties of polynomials, Symmetric functions, Applications symmetric function of the roots etc.</p> <p><b>CO6</b> - Solve maximum and minimum values of a polynomials, Algebraic solutions of the cubic and biquadratic etc.</p>
<b>BMTS-404</b>	<b>Number Theory</b>	<p><b>CO1</b> - Learn and gain knowledge about some important results in the theory of numbers including the prime number theorem and their consequences.</p>

		<p><b>CO2</b> - Understand about number theoretic functions, modular arithmetic and their applications.</p> <p><b>CO3</b> - Apply the properties of Dirichlet product in various problems.</p> <p><b>CO4</b> - Classify modular arithmetic and find primitive roots of prime and composite numbers.</p> <p><b>CO5</b>- Assess Gold Bach conjecture, binary and decimal representation of integers, prime counting function etc.</p> <p><b>CO6</b>- Solve Number theoretic functions, totally multiplicative functions, linear congruence, complete set of residues etc.</p>
<b>BMTD-501</b>	<b>Matrices</b>	<p><b>CO1</b> - Definition of vector space, standard basis, subspaces etc.</p> <p><b>CO2</b> - Explain the types of matrices, eigen vector spaces and invariant spaces.</p> <p><b>CO3</b> Apply in reduction to diagonal form upto matrices of order 3.</p> <p><b>CO4</b> Distinguish <math>R_1</math>, <math>R_2</math>, <math>R_3</math> as vector spaces over <math>R</math>. Subspaces of <math>R_2, R_3</math>.</p> <p><b>CO5</b> <b>Evaluate</b> rank under elementary transformations, eigen spaces as invariant subspaces etc.</p> <p><b>CO6</b> Write Matrices in diagonal form, Matrix form of basic geometric transformations, eigen spaces as invariant subspaces etc.</p>
<b>BMTD-502</b>	<b>Mechanics</b>	<p><b>CO1</b> Identify the conditions of equilibrium under forces including friction.</p> <p><b>CO2</b> Understand the centre of gravity, work and potential energy etc.</p> <p><b>CO3</b> Use in simple harmonic motion and in simple pendulum.</p> <p><b>CO4</b> Compare the radial and transverse components etc.</p> <p><b>CO5</b> Discriminate Problems of equilibrium under forces including friction, Velocity and acceleration of a particle along a curve: radial and transverse components etc.</p> <p><b>CO6</b> Write Conditions of equilibrium of a particle, tangential and normal components etc.</p>
<b>BMTD-503</b>	<b>Linear Algebra</b>	<p><b>CO1</b> Define linear transformations, compute eigen values and eigen vectors.</p> <p><b>CO2</b> Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.</p> <p><b>CO3</b> Apply properties of inner product spaces and determine orthogonality in inner product spaces.</p>

		<p><b>CO4</b> Compare the properties of Isomorphism, Homomorphism etc and use in change of coordinate matrix.</p> <p><b>CO5</b> Evaluate Eigen values and Eigen vectors, Characteristic Polynomial, linear combination of vectors, linear independence etc.</p> <p><b>CO6</b> Solve linear transformations, Characteristic Polynomial, linear combination of vectors etc.</p>
<b>BMTS-504</b>	<b>Probability and Statistics</b>	<p><b>CO1</b> Knowledge of simple space, mathematical expectation etc.</p> <p><b>CO2</b> Describe the characteristic function, discrete distributions etc.</p> <p><b>CO3</b> Solve the problems related probability functions.</p> <p><b>CO4</b> Distinguish the marginal and conditional distributions, joint cumulative and joint probability density function.</p> <p><b>CO5</b> Justify Marginal and conditional distributions, independent random variables, moment generating function, characteristic function etc.</p> <p><b>CO6</b> Write probability axioms, independent random variables, binomial, Poisson, continuous distributions etc.</p>
<b>BMTS-505</b>	<b>Mathematical Finance</b>	<p><b>CO1</b> Knowledge of simple, compound interest, inflation etc.</p> <p><b>CO2</b> Understand the portfolio return, asset return and random returns etc.</p> <p><b>CO3</b> Use in portfolio diagram.</p> <p><b>CO4</b> Comparison of NPV and IRR, bond prices and yields.</p> <p><b>CO5</b> Estimate Inflation, net present value, internal rate of return, brief introduction to expectation etc.</p> <p><b>CO6</b> Write Basic principles of Comparison, arbitrage and risk aversion, Interest, diversification, portfolio diagram, feasible set etc.</p>
<b>BMTS-506</b>	<b>Mathematical Modelling</b>	<p><b>CO1</b> Knowledge of sample space, definition of probability etc.</p> <p><b>CO2</b> Understand the distribution function, probability generating function etc.</p> <p><b>CO3</b> Apply in Bay's theorem, in simple problems.</p> <p><b>CO4</b> Classify the Karl Pearson's Coefficient of Correlation - Rank Correlation - Linear Regression</p> <p><b>CO5</b> Justify Uniqueness and Inversion Theorem, Chebychev's Inequality - Simple Problems, Conditional Probability - Baye's</p>

		<p>Theorem etc.</p> <p><b>CO6</b> - Solve the simple problems like Cumulate Generating Function, Conditional Probability etc.</p>
<b>BMTD-601</b>	<b>Numerical Methods</b>	<p><b>CO1</b> Describe numerical solutions of algebraic and transcendental equations.</p> <p><b>CO2</b> Interpret the numerical solutions of system of linear equations and check the accuracy of the solutions.</p> <p><b>CO3</b> Solve initial and boundary value problems in differential equations using numerical methods.</p> <p><b>CO4</b> Apply various numerical methods in real life problems.</p> <p><b>CO5</b> Evaluate Lagrange and Newton interpolation, Numerical differentiation etc.</p> <p><b>CO6</b> Solve the problems of differences by trapezoidal rule, Simpson's rule, Euler's method and problems of Fixed point iteration method etc.</p>
<b>BMTD-602</b>	<b>Complex Analysis</b>	<p><b>CO1</b> Identify the isolated singularities of a function and determine whether they are removable, poles, or essential.</p> <p><b>CO2</b> Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.</p> <p><b>CO3</b> Apply the concept and consequences of analyticity and the Cauchy-Riemann equations.</p> <p><b>CO4</b> Analyze functions as Taylor, power and Laurent series, find residues and Evaluating complex integrals using the residue theorem.</p> <p><b>CO5</b> Discriminate Analytic functions, exponential function, limits, Liouville's theorem and mappings etc.</p> <p><b>CO6</b> Solve Limits, continuity, derivatives of functions, upper bounds, Taylor and Laurent series and its examples.</p>
<b>BMTD-603</b>	<b>Linear Programming</b>	<p><b>CO1</b> Describe the linear programming problems.</p> <p><b>CO2</b> Explain the two phase method, Big M method etc.</p> <p><b>CO3</b> Apply in formulation of the dual problem.</p> <p><b>CO4</b> Classify the simplex algorithm, simplex method in tableau format.</p> <p><b>CO5</b> <b>Distinguish</b> two-phase method, Big-M method, dual problem, primal- dual relationships etc.</p> <p><b>CO6</b> Solve Linear Programming Problems, simplex method, Duality etc.</p>

<b>BMTS-604</b>	<b>Boolean Algebra</b>	<p><b>CO1</b> Definition of ordered sets, maximal and minimal elements.</p> <p><b>CO2</b> Understand the minimal forms of Boolean polynomials.</p> <p><b>CO3</b> Apply in switching circuits.</p> <p><b>CO4</b> Compare Boolean algebra and Boolean polynomials.</p> <p><b>CO5</b> Summarize Boolean polynomials, maximal and minimal elements.</p> <p><b>CO6</b> Write properties of modular and distributive lattices, applications of switching circuits etc.</p>
<b>BMTS-605</b>	<b>Transportation and Game Theory</b>	<p><b>CO1</b> Define the transportation problems and its mathematical formulation.</p> <p><b>CO2</b> Understand the formulation of two person zero sum games.</p> <p><b>CO3</b> Use Hungarian method for solving assignment problem.</p> <p><b>CO4</b> Compare the northwest – corner method, least cost method, vogel approximation method etc.</p> <p><b>CO5</b> Evaluate Transportation problem and its mathematical formulation etc.</p> <p><b>CO6</b> Solve Games with mixed strategies, two person zero sum games etc.</p>
<b>BMTS-606</b>	<b>Graph Theory</b>	<p><b>CO1</b> Identify vertices, edges and paths with specific properties such as cut vertices, bridges, Eulerian, etc.</p> <p><b>CO2</b> Understand the concepts of Hamiltonian graphs and Planar graph.</p> <p><b>CO3</b> Identify trees and their properties.</p> <p><b>CO4</b> Illustrate the fundamental applications of Graph Theory in different walks of life.</p> <p><b>CO5</b> Evaluate Transportation problem and its mathematical formulation etc.</p> <p><b>CO6</b> Solve Games with mixed strategies, two-person zero sum games etc.</p>

## B.Sc. GEOLOGY

### Program Specific Outcome (PSO)

<b>PSO1</b>	Acquire a knowledge in the Science of geology as a whole as well as Earth materials, Petrology, Geochemistry, Mineralogy, Hydrology, Natural disaster and Stratigraphy, Structural features, and geomorphic processes and landforms.
<b>PSO2</b>	Apply principles of mathematics, chemistry, and physics to geologic problems
<b>PSO3</b>	Use compasses, survey instruments, and satellite images in geological investigations
<b>PSO4</b>	Develop intellectual ability and geological skills through an appropriate blending of theoretical subject education, practical exercises and field training
<b>PSO5</b>	Attain basic knowledge, training, skills and eligibility degree for various higher academic courses and position in Govt. and private sector.

### Course outcome

Course Code	Course Name	Outcome
<b>BGLC101</b>	<b>Physical Geology and Structural Geology</b>	<p><b>CO1</b> Learn and Gain Knowledge to the different component of earth and the evolution of solar system, Processes of weathering and erosion, earthquake, volcanoes. idea of dip, strike, bed, fold, fault and unconformity.</p> <p><b>CO2</b> Develop understanding of about the structure of Earth, Origin of solar system, factors of weathering, erosion, earthquake, volcanoes, elementary idea of stress and strain, fold, fault, unconformity and joints.</p> <p><b>CO3</b> Illustrate the theories of earth, structures, solar system, earthquake, volcanoes, fold, fault, joints and unconformity.</p> <p><b>CO4</b> Correlate various Hypothesis on Origin of Earth, dip and strike, stress and strain, weathering and erosion.</p> <p><b>CO5</b> Measure the dip and strike with the help of clinometer compass/Brunton.</p> <p><b>CO6</b> Write the concept of unconformity, normal, thrust and slip faults.</p>
<b>BGLL101</b>	<b>Lab Course based on BGLC101</b>	<p><b>CO1</b> Gain knowledge about the geomorphological features.</p> <p><b>CO2</b> Understand maps of geological significance.</p> <p><b>CO3</b> Explain the concept of clinometers/Brunton compass</p> <p><b>CO4</b> Differentiate different types of folds/faults from block models</p> <p><b>CO5</b> Measure the dip and strike with the help of clinometer compass/Brunton.</p> <p><b>CO6</b> Preparation of cross section profile from a</p>

		geological map
<b>BGLC201</b>	<b>Mineralogy and Crystallography</b>	<p><b>CO1</b> Learn and Gain Knowledge to the different properties of minerals, silicate structure, Polarizing microscope, Optical properties of mineral, Interfacial angle, Crystallographic axes, Miller system of notations, description of normal classes, and twinning.</p> <p><b>CO2</b> To Understand the mode of occurrences and uses of different mineral groups, silicate structures, optical properties of common minerals, description of normal classes of common crystal.</p> <p><b>CO3</b> Differentiate different crystal systems on the basis of symmetry and other properties, laws of twinning.</p> <p><b>CO4</b> Measure interfacial angle by using contact goniometer, give different notations in crystal.</p> <p><b>CO5</b> Distinguish different minerals on the bases of physical properties, optical properties, crystal system on the bases of symmetry.</p> <p><b>CO6</b> Write the concept of Polarizing microscope....</p>
<b>BGLL201</b>	<b>Lab Course based on BGLC201</b>	<p><b>CO1</b> Identify common rock-forming minerals in hand specimens.</p> <p><b>CO2</b> Understand common rock-forming minerals in thin section.</p> <p><b>CO3</b> Determination of system and class of crystals on the basis of symmetry elements.</p> <p><b>CO4</b> Analyze the hand specimen and rock slide.</p> <p><b>CO5</b> Compare the hand specimen of minerals on the bases of Physical properties of minerals</p> <p><b>CO6</b> Write the notations in crystal system</p>
<b>BGLC301</b>	<b>Petrology</b>	<p><b>CO1</b> Learn and Gain Knowledge of characterize, identify and name different types of rocks in the field and in hand-specimens, and rock-thin sections, and finally they will propose the rock-forming processes.</p> <p><b>CO2</b> Understand the formation, texture, structure of Igneous rock, Sedimentary rock and Metamorphic rock.</p> <p><b>CO3</b> Explain the use of Petrography of Igneous, Sedimentary and Metamorphic rock.</p> <p><b>CO4</b> Classify the Igneous rock, Sedimentary rock and Metamorphic rock,</p>



		<p>Crystallization of uni-component and bi-component (mix-crystals); Bowen's reaction principle</p> <p><b>CO5</b> Distinguish between different type of rocks.</p> <p><b>CO6</b> Write the process of metamorphism, agents of metamorphism, petrography of metamorphic rock.</p>
<b>BGLL301</b>	<b>Lab Course based on BGLC301</b>	<p><b>CO1</b> Describe microscopic properties of igneous, sedimentary and metamorphic rocks.</p> <p><b>CO2</b> Compare different type of rocks in hand specimen and thin section.</p> <p><b>CO3</b> Prepare the slides of different types of rocks.</p> <p><b>CO4</b> Distinguish the rock in microscopic and macroscopic level.</p> <p><b>CO5</b> Analyze the thin section of Igneous, Sedimentary rock and Metamorphic Rock.</p> <p><b>CO6</b> Write the Physical properties of rocks in hand specimen.</p>
<b>BGLS302</b>	<b>Skill (Geomorphology and Geotectonic)</b>	<p><b>CO1</b> Gain Knowledge of Principles of Geomorphology, natural agents of wind, river, glacier, dynamic system of Earth, Plate tectonics.</p> <p><b>CO2</b> Identify the landforms formed by the tectonic activities and the geological work done by a river, glacial processes and wind.</p> <p><b>CO3</b> Apply the principles of Geomorphology in various studies.</p> <p><b>CO4</b> Distinguish between divergent plate and convergent plate boundaries, weathering and erosion, Epigene/exogenic processes:</p> <p><b>CO5</b> Compare the geological work done by river with that of glacier, continental drift.</p> <p><b>CO6</b> Write the concept of plate margins, deep sea trenches, island arcs and volcanic arcs, orogeny and rift valley, sea- floor spreading and mid-oceanic ridges, Paleo magnetism, isostasy.</p>
<b>BGLC401</b>	<b>Stratigraphy Principles and Indian Stratigraphy</b>	<p><b>CO1</b> Learn and Gain Knowledge of fundamentals of stratigraphic principles and various methods of stratigraphic analysis will be provided.</p> <p><b>CO2</b> To understand the concept of Geological Time Scale and Facies concept,</p> <p><b>CO3</b> Explain about the various age group rocks occurring in India and the boundaries separating them, Geological Time events of The Paleozoic, Gondwana, Triassic,</p>

		<p>Jurassic and Cretaceous and the Tertiary Group</p> <p><b>CO4</b> The stratigraphic classification from craton, mobile belt, Proterozoic to Phanerozoic succession from India is the goal of this course.</p> <p><b>CO5</b> Compare the stratigraphy succession on the bases of fossils.</p> <p><b>CO6</b> Write the detailed significance of the Siwalik, Pleistocene, Holocene, Himalayas, and Eocene systems.</p>
<b>BGLL401</b>	<b>Lab Course Based on BGLC401</b>	<p><b>CO1</b> Describe the stratigraphy sequences of various foration.</p> <p><b>CO2</b> Identify hand specimens representing rock Formations of Dehradun.</p> <p><b>CO3</b> Solve problems in stratigraphic correlation.</p> <p><b>CO4</b> Explain the lithostratigraphic maps of India showing geological formation.</p> <p><b>CO5</b> Discriminate stratigraphy Formations based on fossils</p> <p><b>CO6</b> Write the various stratigraphic horizons in outline map of India.</p>
<b>BGLS402</b>	<b>Skill (Micropaleontology &amp; Oceanography)</b>	<p><b>CO1</b> Gain Knowledge to develop skills regarding modern techniques and methods employed in micropaleontology and marine life</p> <p><b>CO2</b> To understand the different Ocean drilling program</p> <p><b>CO3</b> Uses of microfossils and will be able to interpret atmospheric and oceanic circulation systems so as to analyze their driving forces</p> <p><b>CO4</b> Analyze the microfossils on the basis of morphology.</p> <p><b>CO5</b> Evaluate a relationship between ocean chemistry and climate change</p> <p><b>CO6</b> Write the concept of upwelling. El Nino and deep Ocean circulation</p>
<b>BGLD501</b>	<b>Palaeontology</b>	<p><b>CO1</b> Learn and gain Knowledge of fossils, conditions and modes for fossilization, Invertebrate, vertebrate Paleontology, paleobotany and Micropaleontology</p> <p><b>CO2</b> To understand the morphology of the hard parts of different phylum's and geological time range.</p> <p><b>CO3</b> Explain the origin and evolution of life through geological time and the major evolutionary breakthroughs, and to correlate the evolutionary history with other synchronous geological events.</p> <p><b>CO4</b> Distinguish between vertebrate</p>

		<p>Paleontology, Invertebrate Paleontology.</p> <p><b>CO5</b> Distinguish between the upper Gondwana and Lower Gondwana.</p> <p><b>CO6</b> Write the collection techniques of fossils.</p>
<b>BGLL501</b>	<b>Lab Course based on BGLD501</b>	<p><b>CO1</b> Gain Knowledge regarding the identification of fossils.</p> <p><b>CO2</b> To identify fossils/casts/shells w.r.t their morphology and geological age.</p> <p><b>CO3</b> To collect the rock sample from the field</p> <p><b>CO4</b> Correlate the formation of rock on the basis of fossils.</p> <p><b>CO5</b> Compare the rock succession on the basis of fossils.</p> <p><b>CO6</b> To identify the Plant fossils and write its uses.</p>
<b>BGLD502</b>	<b>Element of Geochemistry</b>	<p><b>CO1</b> Learn and Gain Knowledge of the basic concept of the Geochemistry, Structure of earth, geochemistry of earth, solar system, geochemical behaviour of different elements, Chromatography, Eh, pH relations</p> <p><b>CO2</b> Discuss the geochemical classification of elements, Major, minor and trace and elements</p> <p><b>CO3</b> Explain element partitioning in minerals and rocks.</p> <p><b>CO4</b> Idea about Geochemical classification of elements.</p> <p><b>CO5</b> Distinguish between the different Layer of Earth.</p> <p><b>CO6</b> Write the chemical composition characteristics of the Earth</p>
<b>BGLL502</b>	<b>Lab Course based on BGLD502</b>	<p><b>CO1</b> Gain Practical Knowledge of Chromatographic Separation.</p> <p><b>CO2</b> Understand the Practical Concept of PH, dissolve Oxygen in water, chemical oxygen demand.</p> <p><b>CO3</b> Determine the PH of soil samples</p> <p><b>CO4</b> Analyzing the techniques used in geochemical analysis</p> <p><b>CO5</b> Evaluate the result of dissolve Oxygen in water.</p> <p><b>CO6</b> Explain the methodology used in double titration methods.,</p>
<b>BGLS503</b>	<b>SKILL (FIELD GEOLOGY)</b>	<p><b>CO1</b> Learn and Gains knowledge into the methods of geological mapping and can gain expertise by proper practice.</p> <p><b>CO2</b> Understand Rock outcrop.</p> <p><b>CO3</b> Use of field note book and information on personal safety and camping.</p> <p><b>CO4</b> Analyze the rock samples in field.</p> <p><b>CO5</b> Measure the dip direction and dip strike</p>

		from the clinometer compass. <b>CO6</b> Prepare field geological reports
<b>BGLD601</b>	<b>Economic Geology and Hydrology</b>	<b>CO1</b> Learn and Gain knowledge of basic principles of economic geology, Processes of formation of ore deposits, metallic minerals, coal, petroleum, Hydrological cycle, hydrological parameters, origin of earth, geophysical and geological methods of groundwater. <b>CO2</b> Understand the economic value of the ores, Hydrological cycle, origin of groundwater. <b>CO3</b> Explain the formation of ore deposits and coal and petroleum in India. <b>CO4</b> Analyze Groundwater Quality with different methods. <b>CO5</b> Distinguish between various ore deposits of India and Aquifers. <b>CO6</b> To explore groundwater regime through various geophysical methods
<b>BGLL601</b>	<b>Lab Course based on BGLD601</b>	<b>CO1</b> Gain Knowledge samples of ore deposits. <b>CO2</b> Understand the distribution of minerals in India. <b>CO3</b> Prepare of maps showing distribution of important metallic and non-metallic deposits and important coal and oil fields of India. <b>CO4</b> Analyze the samples of economic minerals. <b>CO5</b> Compare the different ore minerals. <b>CO6</b> Solve the problems based on porosity, permeability, specific yield, retention, aquifer..
<b>BGLD602</b>	<b>Engineering and Disaster Management</b>	<b>CO1</b> Gain Knowledge of the basic principles of Engineering geology and disaster. <b>CO2</b> Understand Engineering properties of rocks, selection of Dam, tunnel and bridge. <b>CO3</b> Explain the concept of Earthquake, Volcanoes, landslide. <b>CO4</b> Analyze influence of geological conditions on various engineering structures <b>CO5</b> Awareness of natural disasters for future safety measures and preparedness <b>CO6</b> Solve the problems based on dam and tunnel.
<b>BGLL602</b>	<b>Lab Course based on BGLD602</b>	<b>CO1</b> Gain Knowledge Preparation of engineering geological maps <b>CO2</b> Explain the model of tunnel. <b>CO3</b> Explain the the model of dam. <b>CO4</b> Analyze the grain size of soil and

		sediments. <b>CO5</b> Distinguish between different rocks on the basis of Engineering properties. <b>CO6</b> Solve the problem based on landslide
<b>BGLS603</b>	<b>Remote Sensing and GIS</b>	<b>CO1</b> Learn and Gain Knowledge of Remote sensing and GIS. <b>CO2</b> To understand the interpretation of photography. <b>CO3</b> Use of Remote Sensing in various field. <b>CO4</b> Analyze various physiographical features through GIS <b>CO5</b> Evaluate the data with the help of satellites. <b>CO6</b> Write the GIS concept.

**BACHELOR OF SCIENCE  
(ZOOLOGY)**

**Program Specific Outcome (PSOs)**

<b>PSO-1</b>	Identify and understand the invertebrates as well as vertebrates.
<b>PSO-2</b>	Understand the basic and advanced aspects of animal physiology & biochemistry, anatomy & developmental biology, genetics and evolution, cell biology, molecular biology, immunology, etc.
<b>PSO-3</b>	Know the concepts and applications of animal behaviour & ecology, wildlife conservation and management, applied zoology.
<b>PSO-4</b>	Learn and apply the knowledge of Pisciculture, Sericulture, Aquarium Fish Keeping, Apiculture Public Health and Hygiene, Poultry Farming, and Aquatic Biology.

**Course Outcome (CO)**

<b>Course Code</b>	<b>Course Name</b>	<b>Outcome</b>
<b>BZOC-101</b>	<b>Animal Diversity</b>	<b>CO1</b> Identify the various non-chordates and chordates based on characteristics. <b>CO2</b> Discuss the diversity and various adaptation found in vertebrates and invertebrates. <b>CO3</b> Classify the animal world based on their modification in their body plan, organization, symmetry etc. <b>CO4</b> Investigate the structural and functional aspects of various body systems in animal world. <b>CO5</b> Conclude the various morphological adaptation in animal world. <b>CO6</b> Generate the order of evolution of animal world based on adaptation and their various characteristics.
<b>BZOL-101</b>	<b>Lab Course Based On BZOC101</b>	<b>CO1</b> Identify the animal with their keys. <b>CO2</b> Illustrate the keys as characteristics of animal. <b>CO3</b> Apply the keys for Album creation depicting diversity of animals. <b>CO4</b> Contrast and compare the keys as a characteristic with aid of diagram. <b>CO5</b> Conclude and Argue the significance of keys in animal world <b>CO6</b> Rewrite a Plan to illustrate the evolution of keys as a adaptation tool.
<b>BZOC-201</b>	<b>Comparative anatomy and developmental biology of vertebrates</b>	<b>CO1</b> Identify the developmental, structural and functional aspects of various body systems in animal world. <b>CO2</b> Illustrate the concept of embryonic developmental and the anatomical significance in animal world. <b>CO3</b> Classify and demonstrate the embryonic and anatomical developmental diversion

		<p>found in animal world.</p> <p><b>CO4</b> Organize and outline the peculiarity and similarity found in animals.</p> <p><b>CO5</b> Critique and Evaluate the process of embryonic and anatomical development.</p> <p><b>CO6</b> Generate and Integrate the various embryonic and anatomical process in animal kingdom.</p>
<b>BZOL-201</b>	<b>Lab course based on BZOC201</b>	<p><b>CO1</b> Draw out the difference between the bones of skull, vertebral column, appendages, etc. of herbivores and carnivores. Identify the various stages of development through slides.</p> <p><b>CO2</b> Compare the skeleton of animals based on their adaptation. Illustrate the significance of various developmental stages.</p> <p><b>CO3</b> Demonstrate the Skeletal structure of animals. Show the various pre and postembryonic development stages and the various types of placenta.</p> <p><b>CO4</b> Organize the Skeleton based on morphological changes due to habitat. Make a Diagrammatic study showing the changes occur in different stages of development.</p> <p><b>CO5</b> Conclude the Skeletal structure found in animal kingdom and the entire development process with the aid of a slides.</p> <p><b>CO6</b> Integrate and formulate the skeletal structure of animal. Formulate the plan of embryonic development with the aid of a diagram</p>
<b>BZOL-301</b>	<b>Lab course based on BZOC301</b>	<p><b>CO1:</b> Identify the various histological slides of animals. Find the lipids, carbohydrates and protein in a given solution.</p> <p><b>CO2:</b> Summarize the given slides based on their characteristics. Proteins, lipids and carbohydrates estimation in a given sample.</p> <p><b>CO3:</b> Demonstrate the serological experiment (Hb %, RBC, WBC etc). Implement various biochemical experiments.</p> <p><b>CO4:</b> Examine and contrast the slides of various organs. Simplify the activity and outline the activity of salivary amylase.</p> <p><b>CO5:</b> Conclude and evaluate the slides of vital organs and the functional group of protein.</p> <p><b>CO6:</b> Generate and formulate the salient feature of the physiological slides and biochemical</p>

		assay.
<b>BZOS-302</b>	<b>Pisciculture</b>	<p><b>CO1:</b> Identify the various fresh and marine fish species.</p> <p><b>CO2:</b> Compare and Discuss the various techniques to manage the fish farm.</p> <p><b>CO3:</b> Demonstrate the various fish culture techniques.</p> <p><b>CO4:</b> Organise the fish culture techniques associated with the various fish species.</p> <p><b>CO5:</b> Conclude and Categories the various culture activity along with their maintenance parameters.</p> <p><b>CO6:</b> Integrate and Formulate a plan for the different fish species living in different habitats.</p>
<b>BZOS-303</b>	<b>Sericulture</b>	<p><b>CO1:</b> Identify the various mulberry plantation and cultivation techniques.</p> <p><b>CO2:</b> Compare and Discuss the various techniques to manage the silkworm rearing techniques.</p> <p><b>CO3:</b> Demonstrate the various diseases of mulberry and their control remedies.</p> <p><b>CO4:</b> Organise the silkworm rearing techniques associated with the various silkworm species.</p> <p><b>CO5:</b> Conclude and Categories the various culture activity along with their physical and commercial characteristics..</p> <p><b>CO6:</b> Integrate and Formulate a plan for the different mulberry and silkworm species living in different habitats.</p>
<b>BZOC-401</b>	<b>Genetics and evolutionary biology</b>	<p><b>CO1:</b> Describe the significance of Genetics in study of animal world and its influence in evolution of vast diversity of fauna .</p> <p><b>CO2:</b> Discuss the various concept and mechanism (crossing-over, linkage, gene mapping methods, Extra chromosomal inheritance etc.) and its correlation with the various evolutionary theories.</p> <p><b>CO3:</b> Demonstrate and show how the evolutionary theories are related with genetics concept (Mutation, Quantitative Genetics).</p> <p><b>CO4:</b> Investigate and simplify with the aid of diagram the origin and extinct of species, in your surrounding with the genetics theory.</p> <p><b>CO5:</b> Conclude and Critique the genetic theory with process of evolutionary change and species richness in an habitat.</p> <p><b>CO6:</b> Integrate and rewrite the plan for the evolution of animal species along with the genetics theory which is guiding it.</p>
<b>BZOL-</b>	<b>Lab course based on BZOC</b>	<p><b>CO1:</b> Describe and find about various genetics Theory (Mendel's laws and gene</p>



<b>401</b>	<b>401</b>	<p>interactions) through suitable examples (genetic disorders, pedigree analysis, multiple alleles, etc.).</p> <p>Identify the traits of homology and analogy from given specimen.</p> <p><b>CO2:</b> Associate the genetic data with the statistical tools (Chi-Square etc.) and Illustrate the origins of animal traits using specimen and charts..</p> <p><b>CO3:</b> Apply the gained knowledge and Implement the relationship within the species regarding the trait's development.</p> <p><b>CO4:</b> Make a diagram and contrast a relationship between the given specimen model.</p> <p><b>CO5:</b> Prove and Evaluate the role of linkage, recombination in species richness in an habitat.</p> <p><b>CO6:</b> Formulate and generate the plan how the genetic evolution has taken in fauna.</p>
<b>BZOS-402</b>	<b>Aquarium fish keeping</b>	<p><b>CO1:</b> Identify the scope of fish rearing in aquarium as a potential venture.</p> <p><b>CO2:</b> Discuss and distinguish the characters and sexual dimorphism in respect to fresh and marine fishes.</p> <p><b>CO3:</b> Demonstrate how the various species can be groomed in aquarium.</p> <p><b>CO4:</b> Investigate and Outline the various process involved in making fish rearing in aquarium</p> <p><b>CO5:</b> Conclude and Evaluate the various rearing techniques used for the fish species individually.</p> <p><b>CO6:</b> Formulate and generate a plan schedule with various fish species for their high survivability and profitability.</p>
<b>BZOS-403</b>	<b>Apiculture</b>	<p><b>CO1:</b> Identify the scope of apiculture as a potential venture.</p> <p><b>CO2:</b> Discuss and distinguish the characters of honey bee species and various maintenance process to be done in upkeeping their hive.</p> <p><b>CO3:</b> Demonstrate how the various species can be groomed.</p> <p><b>CO4:</b> Investigate and Outline the various process involved in making bee keeping with respect to various bee species.</p> <p><b>CO5:</b> Conclude and Evaluate the various rearing techniques used for the bee keeping with respect to their species.</p> <p><b>CO6:</b> Formulate and generate a plan schedule with various bee species for their high survivability and profitability.</p>
<b>BZOD</b>	<b>Reproductive biology</b>	<p><b>CO1:</b> Describe the Gonadal Hormone and their action mechanism.</p>

- 501		<p><b>CO2:</b> Understand and Summarize the kinetics and hormonal regulation involved in spermatogenesis and oogenesis.</p> <p><b>CO3:</b> Demonstrate role of Hormonal control during Male and female reproduction</p> <p><b>CO4:</b> Analyse and contrast different Assisted Reproductive Technology.</p> <p><b>CO5:</b> Evaluate and conclude the functional anatomy of Gonadal hormone.</p> <p><b>CO6:</b> Generate and Formulate the various issue comforting reproductive health and their remedies.</p>
<b>BZOL-501</b>	<b>Lab course based on BZOD501</b>	<p><b>CO1:</b> Find out the various operating process involved in maintenance of animal house.</p> <p><b>CO2:</b> Associate and discuss about various histological sections of reproductive organ and Surgical techniques.</p> <p><b>CO3:</b> Apply the gained knowledge in demonstrating how animal house can be managed.</p> <p><b>CO4:</b> Examine and comment about various histological section from the given slide.</p> <p><b>CO5:</b> Evaluate Sperm count and sperm motility in rat and Conclude and Critique about various slides of rat/human.</p> <p><b>CO6:</b> Formulate and Integrate all modern contraceptive devices with there pro and cons.</p>
<b>BZOD-502</b>	<b>Wildlife conservation and management</b>	<p><b>CO1:</b> Arrange and List the various physical and biological Parameters involved in managing wildlife.</p> <p><b>CO2:</b> Illustrate the various method used for calculating the species population and richness in the stated community.</p> <p><b>CO3:</b> Relate the significance of various biological factors in Protecting the Protected Area.</p> <p><b>CO4:</b> Investigate and organize the various challenges involved in managing the protected Area.</p> <p><b>CO5:</b> Evaluate and Conclude the various approach to estimate the populations in an habitat.</p> <p><b>CO6:</b> Integrate and Combine a plan approach to conserve wildlife and manage them.</p>
<b>BZOL-502</b>	<b>Lab course based on BZOD502</b>	<p><b>CO1:</b> Identify the various techniques available in conserving bio-diversity.</p> <p><b>CO2:</b> Associate and discuss the basic equipment needed in Wildlife Studies.</p> <p><b>CO3:</b> Apply and demonstrate the various method of field study concerning with flora and fauna.</p> <p><b>CO4:</b> Distinguish and contrast between the various techniques available for counting</p>

		<p>species richness.</p> <p><b>CO5:</b> Evaluate and conclude about methods used for ground cover assessment.</p> <p><b>CO6:</b> Formulate and Generate how evidence are used for monitoring and diversity indexing</p>
<b>BZOD -503</b>	<b>Animal Behavior and Ecology</b>	<p><b>CO1:</b> Describe how animals behaviour have evolved and learn new information.</p> <p><b>CO2:</b> Illustrate how chemical and hormone control the communication with in the animal kingdom.</p> <p><b>CO3:</b> Demonstrate how biogeochemical cycle affect the fauna of the animal living in a community.</p> <p><b>CO4:</b> Analyze the role of habitat and ecological niche in species richness of a community.</p> <p><b>CO5:</b> Evaluate and conclude the various Law suggesting the health of an habitat.</p> <p><b>CO6:</b> Rewrite a plan for Environmental Impact Assessment in your surroundings.</p>
<b>BZOL -503</b>	<b>Lab course based on BZOD503</b>	<p><b>CO1:</b> Arrange the various models of animal behaviour.</p> <p><b>CO2:</b> Associate various biogeochemical cycles with animal behaviour.</p> <p><b>CO3:</b> Apply the effect of biochemical cycle on the terrestrial and aquatic animal.</p> <p><b>CO4;</b> Examine and Contrast with diagram how biochemical cycles effect Soil and water physico-chemical parameter.</p> <p><b>CO5:</b> Evaluate various techniques used to count the animal's population in a community and Prove which habitat is most prone to which biochemical cycle.</p> <p><b>CO6:</b> Formulate and put a plan by rewriting the soil and water physico-chemical parameter in respect to various biogeochemical cycles.</p>
	<b>Public health and hygiene</b>	<p><b>CO1:</b> Identify the importance of public health in our life.</p> <p><b>CO2:</b> Illustrate how environmental degradation affects human health.</p> <p><b>CO3;</b> Construct and Implement a plan to summarize the list of communicable and non-communicable disease along with their prevention mechanism.</p> <p><b>CO4:</b> Investigate and Organised the impact of non-communication disease in our society and its possible preventive measure.</p> <p><b>CO5:</b> Evaluate and Conclude the challenges effecting public health along with their possible remedial action.</p> <p><b>CO6:</b> Integrate and Generate a report of WHO run program and their effects on our public health.</p>

<b>BZOS-505</b>	<b>Poultry Farming</b>	<b>CO1:</b> Identify the fowl species based on their uses. <b>CO2:</b> Associate the various fowl species morphology used in selecting their purpose of breeding. <b>CO3:</b> Demonstrate the various management approach used in managing the poultry farms. <b>CO4:</b> Examine and Organize how the managing approach changes for fowl after separating according to their uses. <b>CO5:</b> Critique and Evaluate the various diseases comforting the fowl and their management. <b>CO6:</b> Formulate a progressive plan to manage the poultry farm.
<b>BZOD-601</b>	<b>Molecular biology</b>	<b>CO1:</b> Describe the structure of DNA and RNA. <b>CO2:</b> Explain the process of DNA damage and repair. <b>CO3:</b> Demonstrate the process of transcription in eukaryotes. <b>CO4:</b> Categories and contrast how RNA and DNA synthesis are similar and different. <b>CO5:</b> Prove DNA is the genetic material <b>CO6:</b> Formulate the plan how RNA is regulated in prokaryotes and eukaryotes.
<b>BZOL-601</b>	<b>LAB COURSE BASED ON BZOD601</b>	<b>CO1:</b> Describe the DNA and RNA structure along with its types. <b>CO2:</b> Explain the process of Extracting Plasmid DNA. <b>CO3:</b> Demonstrate the process of DNA isolation from bacteria cell. <b>CO4:</b> Categories and contrast how RNA and DNA structure are similar and different. <b>CO5:</b> Prove DNA is a genetic material <b>CO6:</b> Formulate the plan how Agarose gel electrophoresis.
<b>BZOD-602</b>	<b>Immunology</b>	<b>CO1:</b> Describe the concept of Immunology. <b>CO2:</b> Explain the basic structure of Antigen and Antibodies. <b>CO3:</b> Demonstrate and Relate how antigen and antibodies interact with each other. <b>CO4:</b> Analyze how vaccine aids in immunizing the body. <b>CO5:</b> Evaluate and Conclude how immune system works. <b>CO6:</b> Integrate and combine autoimmunity and immunodeficiency as a part of immune system.
<b>BZOL-602</b>	<b>Lab course based on BZOD602</b>	<b>CO1:</b> Identify the various cell and organs involved in immune system. <b>CO2:</b> Explain the basic behind blood group determination. <b>CO3:</b> Demonstrate and Relate how antigen and

		<p>antibodies interact with each other.</p> <p><b>CO4:</b> Analyse how vaccine aids in immune - electrophoresis within the body.</p> <p><b>CO5:</b> Evaluate and Conclude the role of spleenocytes in providing immune to the body.</p> <p><b>CO6:</b> Integrate and combine the role of all organs which are part of immune system.</p>
<b>BZOD-603</b>	<b>Applied Zoology</b>	<p><b>CO1:</b> Arrange and describe the scope of applied zoology.</p> <p><b>CO2:</b> Associate and Illustrate the economic scope and its threats (Diseases , Parasites etc.) to the various livestock's, Insects, Fowl and Fishes .</p> <p><b>CO3:</b> Apply and show how genetic improvement can be done in increasing the sustainability of applied zoology.</p> <p><b>CO4:</b> Investigate and simplify the various Epidemiology threats to the various form of applied zoology.</p> <p><b>CO5:</b> Evaluate and Conclude how applied zoology can be made more profitable and induced a job opportunity.</p> <p><b>CO6:</b> Formulate a plan for various form of applied zoology to mitigate the threats.</p>
<b>BZOL-603</b>	<b>Lab course based on BZOD603</b>	<p><b>CO1:</b> Arrange and Identify the given specimen according to the uses and threats,</p> <p><b>CO2:</b> Associate and Illustrate the economic scope and its threats (Diseases, Parasites etc.) to the field of applied zoology.</p> <p><b>CO3:</b> Demonstrate the various vectors associated with the spread of disease to humans.</p> <p><b>CO4:</b> Investigate and simplify the various threat to human according to their chance of happening.</p> <p><b>CO5:</b> Evaluate and Conclude how applied zoology can be made more profitable.</p> <p><b>CO6:</b> Formulate a plan for various form of applied zoology to mitigate the threats.</p>
<b>BZOD-604</b>	<b>Cell Biology</b>	<p><b>CO1:</b> Describe the scope and diversity in size, shape, and functions of Cells.</p> <p><b>CO2:</b> Discuss the basic concepts of the cell, cell organelles, and their function.</p> <p><b>CO3:</b> Demonstrate the structural and functional aspects of the basic unit of life i.e. cell concept</p> <p><b>CO4:</b> Examine the structure and function of Plasma membrane.</p> <p><b>CO5:</b> Argue Cancer (tumour) is an act of Mitosis or Meiosis.</p> <p><b>CO6:</b> Formulate the Molecular aspects of cell division.</p>

<b>BZOL 604</b>	<b>Lab course based on BZOD 604</b>	<p><b>CO1:</b> Identify the stages of cell division from the given slides.</p> <p><b>CO2:</b> Discuss the basic stages of mitosis and meiosis.</p> <p><b>CO3:</b> Demonstrate the structural and functional aspects of the basic unit of life i.e. cell division</p> <p><b>CO4:</b> Examine the structure and function of cell organelles based on their function.</p> <p><b>CO5:</b> Evaluate and Conclude how various cell organelles can be isolated.</p> <p><b>CO6:</b> Formulate the Molecular aspects of cell division along with their cell organelles.</p>
<b>BZOS -605</b>	<b>Aquatic Biology</b>	<p><b>CO1:</b> Identify and compare freshwater bodies with marine water bodies.</p> <p><b>CO2:</b> Express the process of the creation of a lake and stream.</p> <p><b>CO3:</b> Demonstrate how marine animals have adapted themselves to survive in saline water.</p> <p><b>CO4:</b> Categories the various challenges facing the water bodies.</p> <p><b>CO5:</b> Evaluate the Physicochemical Characteristics of river, stream and Marine habitats</p> <p><b>CO6:</b> Formulate and generate the threats to the aquatic biology</p>
<b>BZOS- 606</b>	<b>Bioinformatics and biostatistics</b>	<p><b>CO1:</b> Arrange and describe the scope of Bio Informatics.</p> <p><b>CO2:</b> Associate the various computer toolkit needed to support bio informatics.</p> <p><b>CO3:</b> Apply the importance of Biostatistics as a tool in research.</p> <p><b>CO4;</b> Organize and Outline the relation of Life science with computer and math.</p> <p><b>CO5:</b> Evaluate and conclude the various tools used for Data Analysis.</p> <p><b>CO6:</b> Integrate and formulate the use of various biostatistical tools with the software kit.</p>

## B. Sc. (Hons.) BIOTECHNOLOGY

### Program Specific Outcome (PSO)

<b>PSO 1</b>	The students will understand the basic metabolic and molecular processes required for normal cellular functions.
<b>PSO2</b>	The students will learn about different tools and techniques required for genetic manipulation, microbial culture and biochemical analysis.
<b>PSO3</b>	The students will be able to execute basic experiments related to biochemistry, microbiology, cell biology, recombinant DNA technology, etc.
<b>PSO4</b>	The students will be able to pursue higher studies in diverse areas of biological sciences or take up jobs in various biotechnology sectors.

### Course Outcome (CO)

Course Code	Course Name	Outcome
<b>HBTC 101</b>	<b>Biochemistry and Metabolism</b>	<p><b>CO1- Remember</b> the define the terms and basic concepts of Biochemistry and Metabolism and their different roles in biological systems, Nucleic Acid Metabolism</p> <p><b>CO2- Understand</b> and Remember the principle, mechanism of basic and advanced Biochemistry and Metabolism, Nucleic Acid Metabolism.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed process of structure and function of biomolecules and enzymes, Nucleic Acid Metabolism.</p> <p><b>CO4- Analyzing</b>, applying, remembering, understanding the coordinated regulation of carbohydrate, Protein and lipid metabolic pathway, nucleic acid metabolism.</p> <p><b>CO5- Evaluating, analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of Biochemical enzymes and molecules, nucleic acid metabolism.</p> <p><b>CO6- Constructing (Creating)</b>, evaluating, analyzing, demonstrating, remembering, and understanding the Biomolecules and Enzymes, nucleic acid metabolism</p>
<b>HBTC 102</b>	<b>Cell Biology</b>	<p><b>CO1- Remember</b> the define the terms and basic concepts of cell biology and their different roles in biological systems</p> <p><b>CO2- Understand</b> and Remember the principle, mechanism of cellular reaction like cell membrane functions, membrane vacuolar system, intracellular compartmentization and extracellular complexes.</p> <p><b>CO3- Applying, understanding and remembering</b> the detailed processes of structure and function of Cell</p>

		<p>membrane, cytoplasmic organelles and different components of cells.</p> <p><b>CO4- Analyzing, Applying, remembering, Understanding</b> the detailed processes of structure and function of Membrane carbohydrates, lipids and proteins, cytoplasmic organelles and different components of cells.</p> <p><b>CO5- Evaluating, Analyzing, Applying, remembering, and understanding</b> the principle, methods, properties, functions and isolation of Biochemical cell's components and organelles.</p> <p><b>CO6- Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the cell biology and cancer biology. Create awareness to different cellular functions.</p>
<b>HBTG 103</b>		<p><b>CO1- Remember</b> the define the terms and basic concepts of Developmental biology and their different roles in biological systems</p> <p><b>CO2- Understand and Remember</b> the principle, mechanism of cellular reaction like Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO3- Applying, understanding and remembering</b> the detailed processes of Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO4- Analyzing, Applying, remembering, Understanding</b> the detailed processes of structure and function of Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO5 -Evaluating, Analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of developmental biology.</p> <p><b>CO6- Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the developmental biology.</p>
<b>AECC 101</b>	<b>Environmental Science</b>	<p><b>CO1- Remember</b> the define the terms and basic concepts of environmental biology and their different roles to influence biological systems.</p> <p><b>CO2- Understand and Remember</b> the principle, mechanism of cellular reaction like Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO3- Applying, understanding and remembering</b> the detailed processes of Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO4- Analyzing, Applying, remembering, Understanding</b> the detailed processes of structure</p>



		<p>and function of Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO5- Evaluating, Analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of developmental biology.</p> <p><b>CO6- Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the developmental biology.</p>
<b>HBTC 201</b>	<b>Mammalian Physiology</b>	<p><b>CO1- Remember</b> the define the terms and basic concepts of mammalian physiology and their different roles to inflence biological body systems.</p> <p><b>CO2- Understand and Remember</b> the principle, mechanism of cellular reaction like digestion and respiration, muscular system, nervous, endocrine and osmoregulation.</p> <p><b>CO3- Applying, understanding and remembering</b> the detailed processes of digestion and respiration, muscular system, nervous, endocrine and osmoregulation.</p> <p><b>CO4 -Analyzing, Applying, remembering, Understanding</b> the detailed structureand function of digestion and respiration, muscular system, nervous, endocrine and osmoregulation.</p> <p><b>CO5- Evaluating, Analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of mammalian physiology.</p> <p><b>CO6 -Constructing (Creating), Evaluating, analyzing, demonstrating, remembering, and understanding</b> the mammalian physiology and the</p>
<b>HBTC 201</b>	<b>Plant Physiology</b>	<p><b>CO1- Remember</b> and define the terms and basic concepts of plant physiology and their different roles to influence biological plant body systems.</p> <p><b>CO2- Understand and Remember</b> the principle, mechanism of Anatomy, Plant water relations and micro &amp; macro nutrients, Carbon and nitrogen metabolism and Growth and development.</p> <p><b>CO3- Applying, understanding and remembering</b> the detailed processes of Anatomy, Plant water relations and micro &amp; macro nutrients, Carbon and nitrogen metabolism and Growth and development.</p> <p><b>CO4- Analyzing, Applying, remembering, Understanding</b> the detailed study related to Anatomy, Plant water relations and micro &amp; macro nutrients, Carbon and nitrogen metabolism and Growth and development.</p> <p><b>CO5 -Evaluating, Analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of plant physiology.</p> <p><b>CO6- Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the plant physiology and the awareness and appreciation for plants in</p>

HBTG 203	Entrepreneurship Development	<p><b>CO1- Remember</b> and define the terms and basic concepts of entrepreneurship development and their different roles to influencing entrepreneurship, features of a successful Entrepreneurship</p> <p><b>CO2- Understand</b> and Remember the introduction and principle, mechanism of entrepreneurship, features, financing the enterprise, marketing management and entrepreneurship and international business.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes of mechanism of entrepreneurship, features, financing the enterprise, marketing management and entrepreneurship and international business.</p> <p><b>CO4- Analyzing</b>, Applying, remembering, understanding the detailed and complete study related to Biotechnological entrepreneurship features for the growth of individual person and society</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the properties of mechanism of entrepreneurship, features, financing the enterprise, marketing management and entrepreneurship and international business.</p> <p><b>CO6- Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the entrepreneurship and the awareness, appreciation and applicability in environment, and their diverse functions.</p>
	English Communication	<p><b>CO1- Remember</b> the different techniques of word formation; and demonstrate knowledge of synonyms, antonyms and skills of sensible writing.</p> <p><b>CO2- Understand</b> and remember the principle, mechanism of Communication skills, essential techniques and features of effective writing and <b>make use of</b> them in written communication.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes of essential techniques and features of effective writing and <b>make use of</b> them in written communication. Knowledge of synonyms, antonyms and skills of sensible writing.</p> <p><b>CO4- Analyzing</b>, applying, remembering, understanding the detailed study related common errors in English and solve exercises based on them; apply acquired knowledge and skills of oral and written communication in personal and professional life.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of plant physiology.</p> <p><b>CO6- Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the <b>Take part in</b> individual and group communication activities; and <b>determine</b> and <b>invent</b></p>

		new forms and methods of communication to as per the situation.
<b>HBTC 301</b>	<b>Genetics</b>	<p><b>CO1- Remember</b> the different concept of genetics, Mendelian and non-Mendelian genetics of inheritance, Chromosome and genomic organization, Chromosome and gene mutations and Genetic linkage, crossing over and chromosome mapping.</p> <p><b>CO2- Understand</b> and remember the different concept of genetics, Mendelian and non-Mendelian genetics of inheritance, Chromosome and genomic organization, Chromosome and gene mutations and Genetic linkage, crossing over and chromosome mapping.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of effective concept of genetics, Mendelian and non-Mendelian genetics of inheritance, Chromosome and genomic organization, Chromosome and gene mutations and Genetic linkage, crossing over and chromosome mapping.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to different concept of genetics, Mendelian and non-Mendelian genetics of inheritance, Chromosome and genomic organization, Chromosome and gene mutations and Genetic linkage, crossing over and chromosome mapping.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions genetics, Mendelian and non-Mendelian genetics of inheritance, Chromosome and genomic organization, Chromosome and gene mutations and Genetic linkage, crossing over and chromosome mapping.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the <b>Take part in</b> individual and group to different concept of genetics, Mendelian and non-Mendelian genetics of inheritance, Chromosome and genomic organization, Chromosome and gene mutations and Genetic linkage, crossing over and chromosome mapping.</p>

HBTC 302	General Microbiology	<p><b>CO1- Remember</b> the different concept of fundamentals, History and Evolution of Microbiology, microbial diversity, Cultivation and Maintenance of microorganisms, Microbial growth, Microbial Metabolism, Bacterial Reproduction, Control of Microorganisms, water microbiology and food microbiology.</p> <p><b>CO2- Understand</b> and remember the concept of fundamentals, History and Evolution of Microbiology, microbial diversity, Microbial growth, Microbial Metabolism, Bacterial Reproduction, Control of Microorganisms, water microbiology, food microbiology and Cultivation and Maintenance of microorganisms.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to different concept of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p>
HBTC 303	Chemistry- I	<p><b>CO1- Remember</b> the different basic concepts of chemistry: stereochemistry, alkenes and alkynes, Aldehydes and ketones, Free radical substitution reactions, Nucleophilic substitution reactions, Electrophilic Substitution Reactions, Elimination Reactions and the different functional groups.</p> <p><b>CO2- Understand</b> and remember the <b>specific</b> concepts of chemistry: stereochemistry, alkenes and alkynes, Aldehydes and ketones, Free radical substitution reactions, Nucleophilic substitution reactions,</p>

		<p>Electrophilic Substitution Reactions, Elimination Reactions and the different functional groups.</p> <p><b>CO3-Applying</b>, understanding and remembering the detailed processes, essential techniques and features of concepts of chemistry: stereochemistry, alkenes and alkynes, Aldehydes and ketones, Free radical substitution reactions, Nucleophilic substitution reactions, Electrophilic Substitution Reactions, Elimination Reactions and the different functional groups.</p> <p><b>CO4-Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of chemistry: stereochemistry, alkenes and alkynes, Aldehydes and ketones, Free radical substitution reactions, Nucleophilic substitution reactions, Electrophilic Substitution Reactions, Elimination Reactions and the different functional groups.</p> <p><b>CO5-Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of chemistry: stereochemistry, alkenes and alkynes, Aldehydes and ketones, Free radical substitution reactions, Nucleophilic substitution reactions, Electrophilic Substitution Reactions, Elimination Reactions and the different functional groups.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of chemistry: stereochemistry, alkenes and alkynes, Aldehydes and ketones, Free radical substitution reactions, Nucleophilic substitution reactions, Electrophilic Substitution Reactions, Elimination Reactions and the different functional groups.</p>
<b>HB TG 304</b>	<b>Bioethics and Biosafety</b>	<p><b>CO1 -Remember</b> the different basic concepts of introduction to Indian Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Indian Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good</p>

		<p>Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO5 -Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO6 -Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p>
<b>HBTS 305</b>	<b>Industrial Fermentations</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to production of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and</p>

		<p>enzymes, enzyme kinetics.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p>
<b>HBTS 306</b>	<b>Molecular Diagnostics</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p> <p><b>CO3 -Applying,</b> understanding and remembering the detailed processes, essential techniques and features of Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p> <p><b>CO4 -Analyzing,</b> applying, remembering and understanding the detailed study related to concepts of immunological methods, Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the principle, methods, properties and functions of immunological methods, Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in immunological methods, Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p>

HBTS 307	Basics of Forensic Science	<p><b>CO1 -Remember</b> the different basic concepts of introduction and principles of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of crime scene detection methods, forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p>
HBTS 308	Green Chemistry	<p><b>CO1- Remember</b> the different basic concepts of</p>



		<p>introduction and principles of green chemistry, sustainable development, Bio catalysis, Photochemistry, electrochemistry and fuel cells.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of green chemistry, sustainable development, Bio catalysis, Photochemistry, electrochemistry and fuel cells.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of green chemistry, sustainable development, Biocatalysis, Photochemistry, electrochemistry and fuel cells.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of green chemistry, sustainable development, Biocatalysis, Photochemistry, electrochemistry and fuel cells.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions green chemistry, sustainable development, Biocatalysis, Photochemistry, electrochemistry and fuel cells.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in green chemistry, sustainable development, Biocatalysis, Photochemistry, electrochemistry and fuel cells.</p>
<b>HBTC 401</b>	<b>Molecular Biology</b>	<p><b>CO1 -Remember</b> the different basic concepts of introduction to DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation.</p> <p><b>CO2 -Understand</b> and remember the specific and basic concepts of DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing, Regulation of gene expression and translation.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination,</p>

		<p>Transcription and RNA processing. Regulation of gene expression and translation.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing. Regulation of gene expression and translation.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in DNA structure and replication, define the terms and basic concepts of Molecular Biology, DNA damage, repair and homologous recombination, Transcription and RNA processing. Regulation of gene expression and translation.</p>
<b>HBTC 402</b>	<b>Immunology</b>	<p><b>CO1-Remember</b> the different basic concepts of introduction to Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA.</p> <p><b>CO4-Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection,</p>

		<p>Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms.</p>
<b>HBTC 403</b>	<b>Chemistry- II</b>	<p><b>CO1 -Remember</b> the different basic concepts of introduction to Carbohydrates, amino acids, peptides, proteins, Enzymes and correlation with drug action and Components of nucleic acids. Enzyme inhibitors and their importance.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Carbohydrates, amino acids, peptides, proteins, Enzymes and correlation with drug action and Components of nucleic acids. Biological roles of DNA and RNA: Replication, Transcription and Translation.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes, essential techniques and features of Carbohydrates, amino acids, peptides, proteins, Enzymes and correlation with drug action and Components of nucleic acids. Biological roles of DNA and RNA: Replication, Transcription and Translation.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to concepts of Carbohydrates, amino acids, peptides, proteins, Enzymes and correlation with drug action and Components of nucleic acids. Biological roles of DNA and RNA: Replication, Transcription and Translation. Enzyme inhibitors and their importance.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Carbohydrates, amino acids, peptides, proteins, Enzymes and correlation with drug action and Components of nucleic acids. Biological roles of DNA and RNA: Replication, Transcription and Translation. Enzyme inhibitors and their importance.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Carbohydrates, amino acids, peptides, proteins, Enzymes and correlation with drug action and Components of nucleic acids. Biological roles of DNA and RNA: Replication, Transcription and Translation. Enzyme inhibitors and their importance.</p>
<b>HBTG 404</b>	<b>Biotechnology</b>	<p><b>CO1- Remember</b> the different basic concepts of</p>

	<b>and Human Welfare</b>	<p>introduction to Industry, protein engineering, enzyme and polysaccharide synthesis, Agriculture, N<sub>2</sub> fixation, Environments, Forensic science and health.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Industry, protein engineering, enzyme and polysaccharide synthesis, Agriculture, N<sub>2</sub> fixation, Environments, Forensic science and health.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Industry, protein engineering, enzyme and polysaccharide synthesis, Agriculture, N<sub>2</sub> fixation, Environments, Forensic science and health.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Industry, protein engineering, enzyme and polysaccharide synthesis, Agriculture, N<sub>2</sub> fixation, Environments, Forensic science and health.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Industry, protein engineering, enzyme and polysaccharide synthesis, Agriculture, N<sub>2</sub> fixation, Environments, Forensic science and health.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Industry, protein engineering, enzyme and polysaccharide synthesis, Agriculture, N<sub>2</sub> fixation, Environments, Forensic science and health.</p>
<b>HBTS 405</b>	<b>Enzymology</b>	<p><b>CO1-Remember</b> the different basic concepts of introduction to isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology.</p>

		<p>technology.</p> <p><b>CO5 -Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology.</p>
<b>HBTS 406</b>	<b>Drug Designing</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and s/w tools for CADD.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and s/w tools for CADD.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and s/w tools for CADD.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and CADD.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and CADD.</p>

<b>HBTS 407</b>	Evolutionary Biology	<p><b>CO1- Remember</b> the different basic concepts of introduction to Variation within populations, Historical review of evolutionary concept, Evidences of evolution and Speciation and reproductive isolation.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Variation within populations, Historical review of evolutionary concept, Evidences of evolution, Speciation and reproductive isolation and heritable variations and their role in evolution.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Variation within populations, Historical review of evolutionary concept, Evidences of evolution, Speciation and reproductive isolation and heritable variations and their role in evolution. Drift; effects of migration/dispersal; population structure.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Variation within populations, Species concept, Historical review of evolutionary concept, Evidences of evolution, Speciation and reproductive isolation and heritable variations and their role in evolution. Drift; effects of migration/dispersal; population structure.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Variation within populations, Species concept, Historical review of evolutionary concept, Evidences of evolution, Speciation and reproductive isolation and heritable variations and their role in evolution. Drift; effects of migration/dispersal; population structure.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part Variation within populations, Species concept, Historical review of evolutionary concept, Evidences of evolution, Speciation and reproductive isolation and heritable variations and their role in evolution. Drift; effects of migration/dispersal; population structure.</p>
<b>HBTC 501</b>	<b>Bioprocess Technology</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to Introduction to bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial</p>

		<p>production.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production.</p>
<b>HBTC 502</b>	<b>Recombinant DNA Technology</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to Introduction to molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of basic principle components of molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques and features of molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to</p>

		<p>concepts of molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in molecular tools used in RDT and applications, Restriction and modification system, hybridization techniques, Genetic engineering in animals, Random and site-directed mutagenesis and Genetic engineering in plants</p>
<b>HBTD 503</b>	<b>Animal Diversity-I</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to Outline of classification of Non-Chordates upto subclasses, Protozoa, Porifera to Arthropoda, Mollusca, Echinodermata and Hemichordata. Apiculture, sericulture.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Non- Chordates upto subclasses, Protozoa, Porifera to Arthropoda, Mollusca, Echinodermata and Hemichordata. Apiculture, sericulture.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques for identification and features of Non- Chordates upto subclasses, Protozoa, Porifera to Arthropoda, Mollusca, Echinodermata and Hemichordata. Apiculture, sericulture.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to Non-Chordates upto subclasses, Protozoa, Porifera to Arthropoda, Mollusca, Echinodermata and Hemichordata. Apiculture, sericulture.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the Non- Chordates upto subclasses, Protozoa, Porifera to Arthropoda, Mollusca, Echinodermata and Hemichordata. Apiculture, sericulture.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Non- Chordates upto subclasses, Protozoa, Porifera to Arthropoda, Mollusca, Echinodermata and Hemichordata. Apiculture, sericulture.</p>



<b>HBTD 504</b>	<b>Animal Biotechnology</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine..</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques for identification and features of animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine.</p>
<b>HBTD 505a</b>	<b>Ecology and Environment Management</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to our environment and ecosystem, energy transfer in an ecosystem, bio-geochemical cycles (N,C,P cycles), pollution &amp; environmental health problems, bio-transformation, environmental biotechnologies, biotechnologies in protection and preservation of environment. Bioremediation, Waste disposal.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of environment and ecosystem, energy transfer in an ecosystem, bio-geochemical cycles (N,C,P cycles), pollution &amp; environmental health problems, bio-transformation, environmental biotechnologies, biotechnologies in protection and preservation of environment.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes, essential techniques for identification and features of environment and ecosystem, energy transfer in an ecosystem, bio-</p>

		<p>geochemical cycles (N,C,P cycles), pollution &amp; environmental health problems, bio-transformation, environmental biotechnologies, biotechnologies in protection and preservation of environment.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to environment and ecosystem, energy transfer in an ecosystem, bio-geochemical cycles (N,C,P cycles), pollution &amp; environmental health problems, bio-transformation, environmental biotechnologies, biotechnologies in protection and preservation of environment.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the environment and ecosystem, energy transfer in an ecosystem, bio-geochemical cycles (N,C,P cycles), pollution &amp; environmental health problems, bio-transformation, environmental biotechnologies, biotechnologies in protection and preservation of environment.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in environment and ecosystem, energy transfer in an ecosystem, bio-geochemical cycles (N,C,P cycles), pollution &amp; environmental health problems, bio-transformation, environmental biotechnologies, biotechnologies in protection and preservation of environment.</p>
<b>HBTD 505b</b>	<b>Intellectual Property Rights</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to IPR, Protection of IPRs, Patents, Copyright, assignment and licence of copyright, trademarks and rights of holder and assignment and licensing of marks.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of IPR, Protection of IPRs, Patents, Copyright, assignment and licence of copyright, trademarks and rights of holder and assignment and licensing of marks. patenting in biotechnology, economic, ethical and depository considerations.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of IPR, Protection of IPRs, Patents, Copyright, assignment and licence of copyright, trademarks and rights of holder and assignment and licensing of marks. patenting in biotechnology, economic, ethical and depository considerations.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to IPR, Protection of IPRs, Patents, Copyright, assignment and licence of copyright, trademarks and rights of holder and assignment and licensing of marks. patenting in biotechnology, economic, ethical and depository considerations.</p>

		<p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the IPR, Protection of IPRs, Patents, Copyright, assignment and licence of copyright, trademarks and rights of holder and assignment and licensing of marks. patenting in biotechnology, economic, ethical and depository considerations.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in IPR, Protection of IPRs, Patents, Copyright, assignment and licence of copyright, trademarks and rights of holder and assignment and licensing of marks. patenting in biotechnology, economic, ethical and depository considerations.</p>
<b>HBTD 506</b>	<b>Plant Diversity-I</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character, classification and economic importance of plants, fungi, plant diseases and general characters, classification &amp; economic importance. Life histories of <i>Marchantia</i> and <i>Funaria</i>.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of plants, fungi, plant diseases and general characters, classification &amp; economic importance. Life histories of <i>Marchantia</i> and <i>Funaria</i>.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of plants, fungi, plant diseases and general characters, classification &amp; economic importance. Life histories of <i>Marchantia</i> and <i>Funaria</i>.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to plants, fungi, plant diseases and general characters, classification &amp; economic importance. Life histories of <i>Marchantia</i> and <i>Funaria</i>.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the plants, fungi, plant diseases and general characters, classification &amp; economic importance. Life histories of <i>Marchantia</i> and <i>Funaria</i>.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part plants, fungi, plant diseases and general characters, classification &amp; economic importance. Life histories of <i>Marchantia</i> and <i>Funaria</i>.</p>
<b>HBTD 507</b>	<b>Plant Biotechnology</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth</p>

		<p>Promoting bacteria.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p>
<b>HBTD 508a</b>	<b>Bioinformatics</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p>

		<p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p>
<b>HBTD 508b</b>	<b>Advance Forensic Science</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of principles of forensic science; forensic science laboratory and its organization, Classification of injuries and their medico-legal aspects, Explosives and ballistics, process of documentation of crime scene by photography, sketching and field notes and Fingerprints, DNA fingerprinting and toxicology.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of forensic science; forensic science laboratory and its organization, Classification of injuries and their medico-legal aspects, Explosives and ballistics, process of documentation of crime scene by photography, sketching and field notes and Fingerprints, DNA fingerprinting and toxicology.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of forensic science; forensic science laboratory and its organization, Classification of injuries and their medico-legal aspects, Explosives and ballistics, process of documentation of crime scene by photography, sketching and field notes and Fingerprints, DNA fingerprinting and toxicology.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to forensic science; forensic science laboratory and its organization, Classification of injuries and their</p>

		<p>medico-legal aspects, Explosives and ballistics, process of documentation of crime scene by photography, sketching and field notes and Fingerprints, DNA fingerprinting and toxicology.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the forensic science; forensic science laboratory and its organization, Classification of injuries and their medico-legal aspects, Explosives and ballistics, process of documentation of crime scene by photography, sketching and field notes and Fingerprints, DNA fingerprinting and toxicology.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in forensic science; forensic science laboratory and its organization, Classification of injuries and their medico-legal aspects, Explosives and ballistics, process of documentation of crime scene by photography, sketching and field notes and Fingerprints, DNA fingerprinting and toxicology.</p>
<b>HBTC 601</b>	<b>Bio-Analytical Tools</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of bio-analytical, Simple microscopy, Principle and law of techniques, Introduction to the principle of chromatography, electrophoresis, blotting techniques and Biosensors and Nanotechnology and their applications.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Biosensors and Nanotechnology and their applications, bio-analytical, Simple microscopy, Principle and law of techniques, Introduction to the principle of chromatography, electrophoresis, blotting techniques and cell fractionation techniques.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of bio-analytical, Simple microscopy, Principle and law of techniques, Introduction to the principle of chromatography, electrophoresis, blotting techniques, Biosensors and Nanotechnology and their applications and cell fractionation techniques.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to bio-analytical tools, Simple microscopy, Principle and law of techniques, Introduction to the principle of chromatography, electrophoresis, blotting techniques, Biosensors and Nanotechnology and their applications and cell fractionation techniques.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the bio-analytical tools, Simple microscopy, Principle and law of techniques, Introduction to the principle of chromatography, electrophoresis, blotting techniques, Biosensors and Nanotechnology and their applications and cell</p>

		<p>fractionation techniques.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in bio-analytical tools, Simple microscopy, Principle and law of techniques, Introduction to the principle of chromatography, electrophoresis, blotting techniques, Biosensors and Nanotechnology and their applications and cell fractionation techniques.</p>
<b>HBTC 602</b>	<b>Genomics &amp; Proteomics</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of Mass spectrometry based methods for protein identification, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and protein sequencing.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in genomics and proteonomics, Computer tools for sequencing projects, Managing and Distributing Genome Data, protein structure, interactions, Determination of sizes (Sedimentation analysis), Analysis of proteomes and genome and</p>

		protein sequencing.
<b>HBTD 603</b>	<b>Animal Diversity-II</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of Proto-chordates, Pisces and Ambhibia, Reptilia, Aves and Mammalia, Comparative anatomy of vertebrates, Comparative anatomy of vertebrates.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Proto-chordates, Pisces and Ambhibia, Reptilia, Aves and Mammalia, Comparative anatomy of vertebrates, Comparative anatomy of vertebrates, Autonomic Nervous system in Mammals and Outline of classification.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of Proto-chordates, Pisces and Ambhibia, Reptilia, Aves and Mammalia, Comparative anatomy of vertebrates, Comparative anatomy of vertebrates, Autonomic Nervous system in Mammals and Outline of classification.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to Proto-chordates, Pisces and Ambhibia, Reptilia, Aves and Mammalia, Comparative anatomy of vertebrates, Comparative anatomy of vertebrates, Autonomic Nervous system in Mammals and Outline of classification.</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the Proto-chordates, Pisces and Ambhibia, Reptilia, Aves and Mammalia, Comparative anatomy of vertebrates, Comparative anatomy of vertebrates, Autonomic Nervous system in Mammals and Outline of classification.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Proto-chordates, Pisces and Ambhibia, Reptilia, Aves and Mammalia, Comparative anatomy of vertebrates, Comparative anatomy of vertebrates, Autonomic Nervous system in Mammals and Outline of classification.</p>
<b>HBTD 604</b>	<b>Microbial Physiology</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character of microbial physiology, Nutritional classification of microorganisms, metabolism transport through membrane, Microbial Growth and effect of environmental factors of microbial growth and microbial physiology.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of measurement of cell numbers, cell mass and metabolic activity, Nutritional classification of microorganisms, metabolism transport through membrane, Microbial Growth and effect of environmental factors of microbial growth and</p>



		<p>microbial physiology.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of measurement of cell numbers, cell mass and metabolic activity, Nutritional classification of microorganisms, metabolism transport through membrane, Microbial Growth and effect of environmental factors of microbial growth and microbial physiology.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to measurement of cell numbers, cell mass and metabolic activity, Nutritional classification of microorganisms, metabolism transport through membrane, Microbial Growth and effect of environmental factors of microbial growth and microbial physiology.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the measurement of cell numbers, cell mass and metabolic activity, Nutritional classification of microorganisms, metabolism transport through membrane, Microbial Growth and effect of environmental factors of microbial growth and microbial physiology.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in measurement of cell numbers, cell mass and metabolic activity, Nutritional classification of microorganisms, metabolism transport through membrane, Microbial Growth and effect of environmental factors of microbial growth and microbial physiology.</p>
<b>HBTD 605</b>	<b>Biostatistics</b>	<p><b>CO1- Remember</b> the different basic concepts of introduction to general character and concepts of biostatistics, Types of Data, Measures biostatistical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of measurement of biostatistics, Types of Data, Measures biostatistical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of biostatistical analysis, Types of Data, Measures biostatistical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p>

		<p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to measurement of biostatistical analysis, Types of Data, Measures biostatistical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the measurement of biostatistical analysis, Types of Data, Measures biostatistical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in biostatistical analysis, Types of Data, Measures biostatistical analysis, Probability classical &amp; axiomatic definition of probability, distributions, sampling, analysis of variance, Correlation and Regression. Emphasis on examples from Biological Sciences.</p>
<b>HBTD 606</b>	<b>Plant Diversity-II</b>	<p><b>CO1- Remember</b> the different basic concepts and introduction to general character of Pteridophytes, types of Pteridophytes, Gymnosperms, types of Gymnosperms, economic importance of gymnosperms and pteridophytes.</p> <p><b>CO2 -Understand</b> and remember the specific and basic concepts of Pteridophytes, types of Pteridophytes, Gymnosperms, types of Gymnosperms, economic importance of gymnosperms and pteridophytes.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of Pteridophytes, types of Pteridophytes, Gymnosperms, types of Gymnosperms, economic importance of gymnosperms and pteridophytes.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to Pteridophytes, types of Pteridophytes, Gymnosperms, types of Gymnosperms, economic importance of gymnosperms and pteridophytes.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the Pteridophytes, types of Pteridophytes, Gymnosperms, types of Gymnosperms, economic importance of gymnosperms and pteridophytes.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Pteridophytes, types of Pteridophytes, Gymnosperms, types of Gymnosperms, economic importance of</p>

		gymnosperms and pteridophytes.
<b>HBTD 607</b>	<b>Medical Microbiology</b>	<p><b>CO1- Remember</b> the basic concepts of general character of medical microbiology, Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogenesis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts of Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogenesis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections.</p> <p><b>CO3- Applying,</b> understanding and remembering the detailed processes and features of Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogenesis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections.</p> <p><b>CO4- Analyzing,</b> applying, remembering and understanding the detailed study related to Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogenesis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections.</p> <p><b>CO5- Evaluating,</b> analyzing, applying, remembering, and understanding the Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogenesis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections.</p> <p><b>CO6- Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogenesis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections.</p>
<b>HBTD 608</b>	<b>Environmental Biotechnology</b>	<p><b>CO1- Remember</b> the basic concepts of general character of environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching. Environmental significance of genetically modified microbes, plants</p>

		<p>and animals.</p> <p><b>CO2- Understand</b> and remember the specific and basic concepts and applications environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed processes and features of Environmental significance of genetically modified microbes, plants and animals, environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching.</p> <p><b>CO4- Analyzing</b>, applying, remembering and understanding the detailed study related to environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals</p> <p><b>CO5- Evaluating</b>, analyzing, applying, remembering, and understanding the environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals.</p> <p><b>CO6- Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals</p>
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**B.Sc. Biotech with CBZ**

**Program Outcome (PO)**

<b>PO-1</b>	Knowledge of Biotechnology and Applied sciences: Students have the basic knowledge of Biotechnology, Biochemistry (Biomolecules), Microbiology, Plant Biotechnology, environmental science, chemistry, Common biology (Botany and Zoology) and understand its applicability or correlate these applied science to nature.
<b>PO-2</b>	Problem analysis: Identify, express, analyze the problems related to Applied (Biotechnology), basic and natural sciences.
<b>PO-3</b>	Design/development of solutions: Students will be able to design or generate solutions of common problems of Applied Sciences (Biotechnology) and its output is to improve public and environmental health.
<b>PO-4</b>	Modern tool usage: Generate, select, and apply appropriate modern techniques and resources for understanding the concept of Biotechnology.
<b>PO-5</b>	Environment and sustainability: Understand the impact of the Applied science and Biotechnology to improve the environmental health and aware about the knowledge and need of sustainable development.
<b>PO-6</b>	Project management, lab culture and Communication : Acquired the skills in handling scientific instruments, planning and performing in laboratory experiments. Communicate effectively on complex Biotechnological activities with the other science community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
<b>PO-7</b>	Future prospective, Individual and Team Work: After the completion of this course students have the option to go for higher studies i.e. M. Sc. and then do some research for the welfare of mankind or prepare for other competitive examination. Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings followed with the knowledge of Biotechnology.
<b>PO-8</b>	Life-long and interdisciplinary approach of learning: Realized how developments in any Biotechnological subject helps in the development of other science subjects and vice-versa and how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments. Recognize the need for and have the preparation and ability to Engage in independent and life- long learning in the broadest context of Biotechnological Change.
<b>PO-9</b>	Effective Writing: Got Skill for Write up in scientific literature and other social media platform related to life science.
<b>PO-10</b>	Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
<b>PO-11</b>	Social Interaction and Ethics: Elicit views of others, mediate disagreements and help reach conclusions in group. Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them settings conclusions in group settings.
<b>PO-12</b>	Interdisciplinary approach and Practical learning: Analyse the relationships among animals, plants, microbes and Industry. Perform procedures as per laboratory standards in the areas of Biochemistry, Bioinformatics, Genomics, industrial biotechnology and fermentation technology.

### **B. Sc. CBZ BIOTECHNOLOGY**

#### **Program Specific Outcome (PSO)**

<b>PSO-1</b>	The students will understand the basic metabolic and molecular processes required for normal cellular functions.
<b>PSO-2</b>	The students will learn about different tools and techniques required for genetic manipulation, microbial culture and biochemical analysis.
<b>PSO-3</b>	The students will be able to execute basic experiments related to biochemistry, microbiology, cell biology, recombinant DNA technology, etc.
<b>PSO-4</b>	The students will be able to pursue higher studies in diverse areas of biological sciences or take up jobs in various biotechnology sectors.

**Course Outcome (CO) B. Sc. CBZ BIOTECHNOLOGY**

Course Code	Course Name	Outcome
<b>BBTC 101</b>	Biochemistry and Metabolism	<p><b>CO1 Remember</b> the define the terms and basic concepts of Biochemistry and Metabolism and their different roles in biological systems, Nucleic Acid Metabolism</p> <p><b>CO2- Understand</b> and Remember the principle, mechanism of basic and advanced Biochemistry and Metabolism, Nucleic Acid Metabolism.</p> <p><b>CO3- Applying</b>, understanding and remembering the detailed process of structure and function of biomolecules and enzymes, Nucleic Acid Metabolism.</p> <p><b>CO4-Analyzing</b>, applying, remembering, understanding the coordinated regulation of carbohydrate, Protein and lipid metabolic pathway, nucleic acid metabolism.</p> <p><b>CO5-Evaluating, analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of Biochemical enzymes and molecules, nucleic acid metabolism.</p> <p><b>CO6-Constructing (Creating)</b>, evaluating, analyzing, demonstrating, remembering, and understanding the Biomolecules and Enzymes, nucleic acid metabolism</p>
<b>AECC 101</b>	Environmental Science	<p><b>CO1 Remember</b> the define the terms and basic concepts of environmental biology and their different roles to influence biological systems.</p> <p><b>CO2 Understand</b> and <b>Remember</b> the principle, mechanism of cellular reaction like Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO3 Applying, understanding and remembering</b> the detailed processes of Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO4 Analyzing, Applying, remembering, Understanding</b> the detailed processes of structure and function of Gametogenesis and Fertilization, Early embryonic development, Embryonic Differentiation and organogenesis.</p> <p><b>CO5 Evaluating, Analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of developmental biology.</p> <p><b>CO6 Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the developmental biology.</p>
<b>BBTC 201</b>	General Biotechnology	<p><b>CO1 Understanding</b> and <b>remembering</b> the principle of genetic engineering and recombinant DNA technology and their different roles in Biotechnology.</p> <p><b>CO2 Remembering</b> and <b>understanding</b> the detailed process of functioning of laboratory requirements for animal cell culture.</p> <p><b>CO3 Remembering, Understanding and analyzing the</b></p>

		<p>general idea for the production of transgenic plants and animals.</p> <p><b>CO4 Remembering, Understanding and analyzing</b> the role of Biotechnological innovations in the area of medical, agriculture, industrial and forensic sciences.</p> <p><b>CO5 Evaluating, Analyzing, Applying, remembering, and understanding</b> the principle, methods, properties and functions of General Biotechnology.</p> <p><b>CO6 Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the General Biotechnology.</p>
<b>AECC 202</b>	English Communication	<p><b>CO1 Remember</b> the different techniques of word formation; and demonstrate knowledge of synonyms, antonyms and skills of sensible writing.</p> <p><b>CO2 Understand</b> and remember the principle, mechanism of Communication skills, essential techniques and features of effective writing and <b>make use of</b> them in written communication.</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes of essential techniques and features of effective writing and make use of them in written communication. Knowledge of synonyms, antonyms and skills of sensible writing.</p> <p><b>CO4 Analyzing</b>, applying, remembering, understanding the detailed study related common errors in English and solve exercises based on them; apply acquired knowledge and skills of oral and written communication in personal and professional life.</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of plant physiology.</p> <p><b>CO6 Constructing (Creating), Evaluating, Analyzing, demonstrating, remembering, and understanding</b> the <b>Take part in</b> individual and group communication activities; and <b>determine</b> and <b>invent</b> new forms and methods of communication to as per the situation.</p>
<b>BBTC 301</b>	<b>General Microbiology</b>	<p><b>CO1 Remember</b> the different concept of fundamentals, History and Evolution of Microbiology, microbial diversity, Cultivation and Maintenance of microorganisms, Microbial growth, Microbial Metabolism, Bacterial Reproduction, Control of Microorganisms, water microbiology and food microbiology.</p> <p><b>CO2 Understand</b> and remember the concept of fundamentals, History and Evolution of Microbiology, microbial diversity, Microbial growth, Microbial Metabolism, Bacterial Reproduction, Control of Microorganisms, water microbiology, food microbiology and Cultivation and Maintenance of microorganisms.</p>



		<p><b>CO3</b> <b>Applying</b>, understanding and remembering the detailed processes, essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO4</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to different concept of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO5</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p> <p><b>CO6</b> <b>Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of microbiology, genetic recombination in microbiology, diversity and metabolism of microbiology along with Control of pathogenic microorganisms, water microbiology and food microbiology.</p>
<b>BBTS 302</b>	<b>I.P.R. Entrepreneurship, Bioethics and Biosafety</b>	<p><b>CO1</b> <b>Remember</b> the different basic concepts of introduction to Indian Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety</p> <p><b>CO2</b> <b>Understand</b> and remember the specific and basic concepts of Indian Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO3</b> <b>Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP)</p> <p><b>CO4</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p> <p><b>CO5</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good</p>

		<p><b>CO6</b> Manufacturing Practices (GMP). <b>Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of Patent Law, IPR Entrepreneurship, the basic regulations of excise, Bioethics and Biosafety, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).</p>
<b>BBTS 303</b>	<b>Basics of Forensic Science</b>	<p><b>CO1</b> <b>Remember</b> the different basic concepts of introduction and principles of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security</p> <p><b>CO2</b> <b>Understand</b> and remember the specific and basic concepts of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security</p> <p><b>CO3</b> <b>Applying</b>, understanding and remembering the detailed processes, essential techniques and features of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO4</b> <b>Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of crime scene detection methods, forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security</p> <p><b>CO5</b> <b>Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security</p> <p><b>CO6</b> <b>Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in forensic science, forensic science laboratory and its organization and service,</p>

		Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security
<b>BBTS 304</b>	<b>Industrial Fermentations</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to production of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics.</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques and features of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the Take part in essential techniques and features of industrial chemicals, biochemicals and chemotherapeutic products, Microbial products of pharmacological interest, Enzyme and cell immobilization techniques in industrial processing, purification of products and enzymes, enzyme kinetics</p>
<b>BBTC 401</b>	<b>Immunology</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA.</p> <p><b>CO2 Understand</b> and remember the specific and basic</p>

		<p>concepts of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Immunology, Immune Response, Immuno-globulins or Antibodies, Regulation of immunoglobulin gene expression, Major Histocompatibility complexes, Immunity to infection, Vaccines &amp; Vaccination and immunodiagnostics – RIA, ELISA. Immunity to different organisms</p>
<b>BBTS 402</b>	<b>Molecular Diagnostics</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques and features of Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of</p>

		<p>antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of immunological methods, Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of immunological methods, Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in immunological methods, Enzyme Immunoassays, Molecular methods in clinical microbiology, Susceptibility tests, standardization of antigen and specific antibodies, GLC, HPLC, Electron microscopy, flowcytometry and cell sorting. Transgenic animals.</p>
<b>BBTS 403</b>	<b>Drug Designing</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling.</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and s/w tools for CADD</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques and features of delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and s/w tools for CADD</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and s/w tools for CADD</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of delivery considerations of biotechnological</p>

		<p>products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and CADD</p> <p><b>CO6 Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part delivery considerations of biotechnological products, Drug targeting and drug delivery systems, vaccines, drug design cycle and molecular modeling, Docking and modeling substrate and CADD</p>
<b>BBTD 501</b>	<b>Bioinformatics</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to general character of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation</p> <p><b>CO3 Applying,</b> understanding and remembering the detailed processes and features of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation</p> <p><b>CO4 Analyzing,</b> applying, remembering and understanding the detailed study related to Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation</p> <p><b>CO5 Evaluating,</b> analyzing, applying, remembering, and understanding the Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation</p> <p><b>CO6 Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p>
<b>BBTD 502</b>	<b>Animal Biotechnology</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of</p>

		<p>biotechnology, animal propagation and genetic modification in medicine</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques for identification and features of animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in animal biotechnology, gene transfer methods in animals, transgenesis, animal diseases need help of biotechnology, animal propagation and genetic modification in medicine.</p>
<b>BBTS 503</b>	<b>Enzymology</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology.</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques and features of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in isolation, crystallization, purification classification and kinetics of enzymes, Two substrate reactions, Allosteric enzymes and Enzyme technology</p>

<b>BBTS 504</b>	<b>Bioprocess Technology</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to Introduction to bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques and features of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part bioprocess technology, Basic principle components of fermentation technology, Principles of upstream processing, oxygen requirement in bioprocess, Bioprocess measurement and Microbial production</p>
	<b>Plant Biotechnology</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to general character of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes and features of plant biotechnology, cryo and</p>



		<p>organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in plant biotechnology, cryo and organogenic differentiation, types of culture, In vitro haploid production, protoplast Isolation and fusion and Plant Growth Promoting bacteria. Somaclonal variation nomenclature, methods, applications basis and disadvantages.</p>
<b>BBTD 602</b>	<b>Environmental Biotechnology</b>	<p><b>CO1 Remember</b> the basic concepts of general character of environmental biotechnology, conventional and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching. Environmental significance of genetically modified microbes, plants and animals</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts and applications environmental biotechnology, conventional and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes and features of Environmental significance of genetically modified microbes, plants and animals, environmental biotechnology, conventional and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to environmental biotechnology, conventional and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and</p>

		<p>understanding the environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals</p> <p><b>CO6 Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in environmental biotechnology, conventionala and modern fuels and their environmental impact, bioremediation, phytoremediation, biodegradation, Bio-fertilizers and Bioleaching, Environmental significance of genetically modified microbes, plants and animals</p>
<b>BBTD 603</b>	<b>Medical Microbiology</b>	<p><b>CO1 Remember</b> the basic concepts of general character of medical microbiology, Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogeneis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections.</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogeneis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections</p> <p><b>CO3 Applying,</b> understanding and remembering the detailed processes and features of Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogeneis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections</p> <p><b>CO4 Analyzing,</b> applying, remembering and understanding the detailed study related to Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogeneis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections</p> <p><b>CO5 Evaluating,</b> analyzing, applying, remembering, and understanding the Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogeneis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and Protozoan infections</p> <p><b>CO6 Constructing (Creating),</b> Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels, Morphology, pathogeneis, symptoms, laboratory diagnosis, Diseases caused by viruses, Fungal and</p>

		Protozoan infections
<b>BBTS 604</b>	<b>Basics of Forensic Science</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction and principles of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes, essential techniques and features of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to concepts of crime scene detection methods, forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the principle, methods, properties and functions of forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, remembering, and understanding the take part in forensic science, forensic science laboratory and its organization and service, Classification of fire arms and explosives, Role of the toxicologist and findings, Principle of DNA fingerprinting, application of DNA profiling in forensic medicine and introduction to Cyber security.</p>
<b>BBTS 605</b>	<b>Cell and tissue culture</b>	<p><b>CO1 Remember</b> the different basic concepts of introduction to general character of cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i></p>

		<p>haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation. Plasmids and vectors</p> <p><b>CO2 Understand</b> and remember the specific and basic concepts of cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation, methods, applications basis and disadvantages</p> <p><b>CO3 Applying</b>, understanding and remembering the detailed processes and features of cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation. Plasmids and vectors</p> <p><b>CO4 Analyzing</b>, applying, remembering and understanding the detailed study related to cell and tissue culture, equipments and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion</p> <p><b>CO5 Evaluating</b>, analyzing, applying, remembering, and understanding the cell and tissue culture, equipment's and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation, <i>in vitro</i> haploid production, protoplast Isolation and fusion. Plant tissue culture media-composition &amp; preparation. Plasmids and vectors.</p> <p><b>CO6 Constructing (Creating)</b>, Evaluating, Analyzing, demonstrating, cell and tissue culture, cryo and organogenic differentiation, types of culture, <i>In vitro</i> haploid production, protoplast Isolation and fusion and Plant Somaclonal variation nomenclature, methods, applications basis and disadvantages. Equipment's and materials for culture technologies, types of culture, Animal cell culture medium, Cell cloning &amp; cell transformation.</p>
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**B.Sc Microbiology**

**Program Specific Outcome (PSO)**

<b>PSO-1</b>	Graduates of B.Sc Microbiology will be able to get insight into the basic aspects of microbiology dealing with various fields of microbiology.
<b>PSO-2</b>	Graduates will gain knowledge about the industrially important microorganisms which will enhance their capability to cope up in the microbiological society.
<b>PSO-3</b>	Graduates will be able to explain the role of microorganisms in food production and preservation and their ability to cause infection.
<b>PSO-4</b>	Graduates will be able to learn the practical aspect related to the subject.

Course Code	Course Name	Outcome
BMBC 101	Introduction To Microbiology	<p><b>CO1</b> Write and describe about the History, scope of microbiology, classification of microorganisms, culture media, Cellular and acellular microorganisms.</p> <p><b>CO2</b> Compare and differentiate between different scientists involved in microbiology, cellular and acellular microorganisms and will be able to explain classification and culture techniques.</p> <p><b>CO3</b> Illustrate and explain contribution of different scientists in field of microbiology, classification system, culture techniques and cellular and acellular microorganisms</p> <p><b>CO4</b> Distinguish between cellular and acellular microorganisms, different culture techniques and will be able to explain classification system, history and scope of microbiology.</p> <p><b>CO5</b> Summarize about history, scope and classification of microorganisms and culture techniques and distinguish between cellular and acellular microorganisms.</p> <p><b>CO6</b> Develop generalized concept about microbiology.</p>
BMBL 101	Lab Course	<p><b>CO1</b> Memorize Safety rules of working and recognize different instruments used in microbiology Laboratory and enumerate total viable count in water/soil sample.</p> <p><b>CO2</b> Identify different types of bacteria and fungi on the basis of different staining techniques</p> <p><b>CO3</b> Prepare different types of solid and liquid media.</p> <p><b>CO4</b> Differentiate between lactose fermentor and non fermentor on MacConkey agar</p> <p><b>CO5</b> Assess characteristic features of Aspergillus, Penicillium, Amoeba and Paramecium</p> <p><b>CO6</b> Prepare isolation of pure culture of bacteria.</p>
BMBC-201	Biochemistry	<p><b>CO1</b> Define basics of bioenergetics, carbohydrates, proteins, lipids and enzymes</p> <p><b>CO2</b> Explain and describe different terminology used in bioenergetics and classify and compare types of biomolecules.</p> <p><b>CO3</b> Illustrate and develop an understanding about families of carbohydrates, storage and structural lipids, proteins, enzymes and its mechanisms.</p> <p><b>CO4</b> Explain bioenergetics, biomolecules and enzymes</p> <p><b>CO5</b> Compare and summarize between biomolecules and enzymes</p> <p><b>CO6</b> Create structure of biomolecules and express an understanding of bioenergetics, biomolecules and enzymes</p>
BMBL-201	Lab Course	<p><b>CO1</b> Define safety rules of working in lab, sterilization techniques and state the principle and working of instruments. Enumeration of bacteria and fungi from given sample</p> <p><b>CO2</b> Estimate quantitatively and qualitatively sugar, protein and lipid in given sample and Identify different types of bacteria and fungi on the basis of different staining techniques.</p>

		<p><b>CO3</b> - Preparation of media, solution and buffers</p> <p><b>CO4</b> - Calculation of moles, molarity, molality and normality and pH of given solution.</p> <p><b>CO5</b> - Assess characteristic features of algae and symptoms of infection of plant pathogen</p> <p><b>CO6</b> - Prepare and maintain pure culture of bacteria.</p>
<b>BMBC 301</b>	<b>Microbial Physiology and Metabolism</b>	<p><b>CO1</b> - Define the terminology related to Microbial Growth and Effect of Environment on Microbial Growth, Nutrient Uptake and Transport, Chemoheterotrophic Metabolism, Chemolithotrophic and Phototrophic Metabolism, Nitrogen Metabolism.</p> <p><b>CO2</b> - Discuss about Microbial Growth and Effect of Environment on Microbial Growth, Nutrient Uptake and Transport, Chemoheterotrophic Metabolism, Chemolithotrophic and Phototrophic Metabolism, Nitrogen Metabolism</p> <p><b>CO3</b> - Explain and illustrate diagrammatically where required about Growth, Growth kinetics and effect of different parameters on growth, diffusion, group translocation and iron uptake, Chemoheterotrophic Metabolism, Chemolithotrophic and Phototrophic Metabolism, Nitrogen Metabolism.</p> <p><b>CO4</b> - Explain and focus on the concept of growth kinetics, active and passive transport, Concept of aerobic and anaerobic respiration, Chemolithotrophic and Phototrophic Metabolism, Nitrogen Metabolism.</p> <p><b>CO5</b> - Summarize about growth, Nutrient Uptake and Transport, Chemoheterotrophic Metabolism, Chemolithotrophic and Phototrophic Metabolism, Nitrogen Metabolism</p> <p><b>CO6</b> - Generalize the concept of Microbial Physiology and Metabolism.</p>
<b>BMBC L301</b>	Lab	<p><b>CO1</b> - Study and plot the growth curve of <i>E. coli</i> by turbidimetric method.</p> <p><b>CO2</b> - Observe the effect of temperature on growth of <i>E. coli</i>. Effect of pH on growth of <i>E. coli</i></p> <p><b>CO3</b> - Illustrate the growth curve of <i>E. coli</i> by standard plate count methods.</p> <p><b>CO4</b> - Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data.</p> <p><b>CO5</b> - Evaluate the effect of solute and water activity on growth.</p> <p><b>CO6</b> - Construct metabolic pathways diagrammatically.</p>
<b>BMBS 302</b>	<b>Microbiology Quality Controlling food and Pharmaceutical Industries</b>	<p><b>CO1</b> - Define good and safe microbiological practices in food and Pharmaceutical Industries.</p> <p><b>CO2</b> - Represent different method to determine microbes, pathogenic microorganisms in food, pharmaceutical and water samples.</p> <p><b>CO3</b> - Discover pathogenic microorganisms from food and water sample.</p> <p><b>CO4</b> - Explain about different microbial standard for different</p>

		<p>food and water sample.</p> <p><b>CO5-</b> Practice good laboratory practices .</p> <p><b>CO6-</b> Express about quality control and quality assurance and validation.</p>
<b>BMBC 401</b>	<b>Molecular Biology</b>	<p><b>CO1-</b> Define Nucleic acid, Chromosome Structure, Replication and Transcription, Mutation and Repair Mechanism Translation, Microbial Genetics .</p> <p><b>CO2-</b> Generalize the concept of genetic material, enzymes in DNA replication, transcription, translation and concept of mutation and repair mechanism</p> <p><b>CO3-</b> Illustrate diagrammatically Transcription and Translation mechanism in prokaryotes and eukaryotes, mutation and repair mechanism</p> <p><b>CO4 -</b> Explain and Differentiate between the types of nucleic acid, role of enzymes involved in replication, transcription and translation in prokaryotes and eukaryotes, types of mutation and DNA repair methods.</p> <p><b>CO5-</b> Summarize the process of replication, transcription, translation, mutation and repair mechanism.</p> <p><b>CO6-</b> Develop structure of Nucleic acid and generalize the concept of molecular biology and microbial genetics.</p>
<b>BMBL 401</b>	<b>Lab Course</b>	<p><b>CO1-</b> Statesemiconservative. replication of DNA through micrographs/schematic representations Visualize DNA by agarose gel electrophoresis</p> <p><b>CO2-</b> Quantitatively estimate DNA and RNA and illustrate the methods of isolation of genomic DNA.</p> <p><b>CO3-</b> Determine quality of DNA</p> <p><b>CO4-</b> Determine the effect of temperature on denaturation of DNA and effect of pH on Study of different types of DNA and RNA using micrographs and model /schematic representations.</p> <p><b>CO5-</b> Test of quality of DNA.</p> <p><b>CO6-</b> Create a competent cell .</p>
<b>BMBS 402</b>	<b>Microbial Diagnosis in Health Clinics</b>	<p><b>CO1-</b> Describe microbial diseases and importance of their diagnosis and procedure of collection of clinical samples.</p> <p><b>CO2-</b> Identify procedure for collection and transport different clinical samples.</p> <p><b>CO3-</b> Examine different clinical samples by different staining techniques, serological and molecular method for detection of diseases.</p> <p><b>CO4-</b> Compare general methods and kits for rapid detection of different diseases and study the causes and symptoms of diseases.</p> <p><b>CO5-</b> Distinguish bacterial, viral, fungal and protozoan diseases of various human body systems.</p> <p><b>CO6-</b> Validate sensitivity and resistivity of bacteria by different methods and detection of diseases</p>



<b>BMBD 501</b>	<b>Medical Microbiology and Immunology</b>	<p><b>CO1-</b> State Host Pathogen Interaction, Microbial Diseases, Define Immunology and Immune Responses, Antigens and Antibodies, Diagnosis and Chemotherapy.</p> <p><b>CO2-</b> Explain host-parasite relationship, symptoms, transmission of infectious microbial diseases, immunological concepts, diagnostic tests etc.</p> <p><b>CO3-</b> Write and explain about infection and its types, microbial diseases, basics of immunology and principle of various diagnostic tests, chemotherapy etc.</p> <p><b>CO4-</b> Explain and Distinguish between various microbial diseases, types of immunity, principles of different diagnostic tests, infection types.</p> <p><b>CO5-</b> Summarize host parasite relation, microbial diseases, basic immunological concept, diagnostic tests, chemotherapy and vaccines.</p> <p><b>CO6-</b> Generalize the basic concept of medical microbiology and immunology.</p>
<b>BMBL 501</b>	<b>Lab Course</b>	<p><b>CO1</b> Identify Cultural characteristics of different bacteria on nutrient agar and in nutrient broth and Gram characteristic and Motility tests</p> <p><b>CO2-</b> Observe Biochemical characteristics like IMViC, TSI, sugar fermentation, nitrate reduction, urease production, oxidase and catalase tests.</p> <p><b>CO3-</b> Illustrate Ouchterlony method for immunodiffusion</p> <p><b>CO4-</b> Explain DOT-ELISA method.</p> <p><b>CO5-</b> Test total Leukocyte Count and Differential Leukocyte Count of the given blood sample</p> <p><b>CO6-</b> Create separation serum from the blood sample.</p>
<b>BMBD 502</b>	<b>Industrial and Food Microbiology</b>	<p><b>CO1-</b> Gain basic knowledge about Industrial Microbiology, Basic Aspect of Fermentation, Microbial Fermentation Processes, Food Spoilage and Preservation, Foodborne Infections and Intoxications</p> <p><b>CO2-</b> Explain about fermenter, screening of microbes for fermentation process, strain improvement, microbial production of industrial products and fermented foods, spoilage of different foods and infection and intoxication</p> <p><b>CO3-</b> Illustrate the basic parts of fermenter and its types, explain basic concepts of fermentations, different fermentation processes, microbial spoilage of food and preservation techniques and food borne infection and intoxication</p> <p><b>CO4-</b> Explain the basic concepts about industrial microbiology and fermentation, microbial fermentation processes, microbial spoilage and preservation and food borne infection and intoxication.</p> <p><b>CO5-</b> Summarize the concept of industrial microbiology, fermentation processes and food microbiology.</p> <p><b>CO6-</b> Generalize the basic knowledge of Industrial and food Microbiology.</p>

<b>BMBL 502</b>	<b>Lab Course</b>	<p><b>CO1-</b> Assess quality of milk sample by MBRT and adulteration test.</p> <p><b>CO2-</b> Estimation of enzyme production by bacterial culture.</p> <p><b>CO3-</b> Determination of the Bacteriological quality of milk and microbiological production of curd.</p> <p><b>CO4-</b> Experiment to perform isolation of microorganisms from dairy and contaminated food sample.</p> <p><b>CO5-</b> Microbial production of Sauerkraut.</p> <p><b>CO6-</b> .Create a production of curdling.</p>
<b>BMBD 503</b>	<b>Bioinformatics</b>	<p><b>CO1-</b> Remember the different basic concepts of introduction to general character of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO2-</b> Understand and remember the specific and basic concepts of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation</p> <p><b>CO3-</b> Applying, understanding and remembering the detailed processes and features of Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO4-</b> Analyzing, applying, remembering and understanding the detailed study related to Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO5-</b> Evaluating, analysing, applying, remembering, and understanding the Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p> <p><b>CO6-</b> Constructing (Creating), Evaluating, Analysing, demonstrating, remembering, and understanding the take part in Bioinformatics, history of Bioinformatics, Sequence Information Sources, Protein Information Sources, techniques for data identifications, Sequence and Phylogeny analysis, Searching Databases and genome annotation.</p>
<b>BMBL 503</b>	<b>Lab</b>	<p><b>CO1-</b> To get familiar about different operating systems - UNIX, LINUX and Windows</p> <p><b>CO2-</b> Demonstrate the use of Bioinformatics databases: NCBI/PDB/DDBJ, Uniprot, PDB</p> <p><b>CO3-</b> Practice sequence retrieval using BLAST and sequence alignment and phylogenetic analysis using</p>

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<b>BMBD 504</b>	<b>Microbial Biotechnology</b>	<p><b>CO1-</b> Define the terms used in microbial biotechnology and industrial biotechnology</p> <p><b>CO2-</b> Describe scope and applications of microbial biotechnology, industrial biotechnology, applications of microbes in biotransformation, bio energy and environment and antisense RNA and RNAi</p> <p><b>CO3-</b> Explain applications of microbial biotechnology, industrial biotechnology, applications of microbes in biotransformation, bio energy and environment and antisense RNA</p> <p><b>CO4-</b> Focus on the application part of microbial biotechnology</p> <p><b>CO5-</b> Summarize the concept of microbial biotechnology</p> <p><b>CO6-</b> Revise the applications of microbial and industrial biotechnology</p>
<b>BMBL 504</b>	<b>Lab</b>	<p><b>CO1-</b> Visualize the rhizobium sp. From root nodule of leguminous plants.</p> <p><b>CO2-</b> Observe nitrogen fixing bacteria from root nodules of leguminous plant.</p> <p><b>CO3-</b> Prepare microbial growth media for the production of antibiotic.</p> <p><b>CO4-</b> Estimation of plant growth promoting potential of rhizobacteria.</p> <p><b>CO5-</b> Estimation of siderophore production.</p> <p><b>CO6-</b> Formulate the biopesticide.</p>
<b>BMBS 505</b>	<b>Biofertilizer and Biopesticides</b>	<p><b>CO1-</b> Describe about Biofertilizer, chemical fertilizer and Biopesticides.</p> <p><b>CO2-</b> Differentiate between Biofertilizer and chemical fertilizer and gain insight into the biopesticide and mechanism biocontrol.</p> <p><b>CO3-</b> Demonstrate isolation, characterization, Inoculum production, mass multiplication and field application of different bacteria and fungi.</p> <p><b>CO4-</b> Focus on general account of microbes used as biopesticide and their advantage.</p> <p><b>CO5-</b> Compare the use of biopesticide over synthetic pesticide.</p> <p><b>CO6-</b> Express awareness about non symbiotic nitrogen fixers, phosphate solubilizers, AM fungi and their field application.</p>
<b>BMBS 506</b>	<b>Management of Human Microbial Diseases</b>	<p><b>CO1-</b> Identify and name Human diseases, microbial diseases, disease outbreak, social issues related to microbial diseases and vaccines.</p> <p><b>CO2-</b> Discuss about infectious and non-infectious diseases, microbial and non-microbial diseases, disease outbreaks and cancer, social issues and vaccines related to microbial diseases.</p>

		<p><b>CO3-</b> Write about the concept of Infectious and non-infectious diseases; Microbial and non-microbial diseases; disease outbreaks, vaccines and its types.</p> <p><b>CO4-</b> Explain about the types of human diseases, microbial diseases and its prevention, disease outbreaks and study of cancer and social issues related to microbial diseases and vaccines.</p> <p><b>CO5-</b> Summarize about Human diseases, microbial diseases, disease outbreak, social issues related to microbial diseases and vaccines.</p> <p><b>CO6-</b> Generalize the concept of management of human microbial diseases.</p>
<b>BMBD 601</b>	<b>Biostatistics And Computer Applications</b>	<p><b>CO1-</b> Describe about statics and statistical methods.</p> <p><b>CO2-</b> Discuss how to calculate central tendencies, statistical tests.</p> <p><b>CO3-</b> Develop and understanding about probability and correlations.</p> <p><b>CO4-</b> Differentiate sample and population</p> <p><b>CO5-</b> Compare component of computer system and types of network.</p> <p><b>CO6-</b> Express Introduction, procedure and problem based on one-way ANOVA.</p>
<b>BMBL 601</b>	Lab Course	<p><b>CO1-</b> Describe calculation of central tendencies, standard deviation and coefficient of variation.</p> <p><b>CO2-</b> Discuss mean, median and mode from grouped and ungrouped data set.</p> <p><b>CO3-</b> Develop skewness and kurtosis, curve fitting.</p> <p><b>CO4-</b> .Differentiate correlation and regression.</p> <p><b>CO5-</b> Compare confidence interval.</p> <p><b>CO6-</b> Express hypothesis test- normal distribution, t-test and chi-square test.</p>
<b>BMBD 602</b>	<b>Plant Pathology</b>	<p><b>CO1-</b> Memorize various plant diseases, their pathology and genetics.</p> <p><b>CO2-</b> Discuss Plant pathology and different stages in the development of disease</p> <p><b>CO3-</b> Explain Microbial pathogenicity and effect of pathogens on host physiological process.</p> <p><b>CO4-</b> Illustrate defence mechanisms in plants; inducible structural defence, inducible structural defence, systemic acquired resistance.</p> <p><b>CO5-</b> Debate Plant disease and how to control the disease.</p> <p><b>CO6-</b> . Propose awareness about host- pathogen interaction.</p>
<b>BMBL 602</b>	<b>Lab</b>	<p><b>CO1-</b> .Describe symptoms of plant diseases.</p> <p><b>CO2-</b> Differentiate between healthy and diseased plants.</p> <p><b>CO3-</b> Collection of diseased plants.</p> <p><b>CO4-</b> Interpret the cause of bacterial, fungal and viral diseases of plants.</p> <p><b>CO5-</b> Categorize plant diseases on the basis of causal organism.</p> <p><b>CO6-</b> Design isolation and identification of pathogenic fungi from diseased plant sample.</p>

<b>BMBD 603</b>	<b>Biosafety And Intellectual Property Rights</b>	<b>CO1-</b> Define understand about biosafety issues in biotechnology. <b>CO2-</b> Classify Biosafety guidelines and national and international regulations. <b>CO3-</b> Sketch the concern and challenges in role of institutional biosafety committees. <b>CO4-</b> Analyse overview of international agreements and different guidelines for using radioisotopes in laboratories and precautions. <b>CO5-</b> Assess the knowledge about IPR and its types. <b>CO6-</b> Generalize Type of patent application and patent laws.
<b>BMBL 603</b>	Lab Course	<b>CO1-</b> List knowledge about BSL-III. <b>CO2-</b> Describe components and design of a BSL-III laboratory. <b>CO3-</b> Practice filling of application for approval for biosafety committee. <b>CO4-</b> Analyze filling primary application for patents. <b>CO5-</b> Assess knowledge about patents, steps of patenting process and filling of primary application for patents. <b>CO6-</b> Generalize steps of a patenting process and develop understanding from case studies.
<b>BMBS 605</b>	<b>Food Fermentation Techniques</b>	<b>CO1-</b> Define fermented foods and state its importance, recognize milk based, grain based, meat and vegetable based fermented foods <b>CO2-</b> Describe types and health benefits of fermented foods, microorganisms involved in fermented foods. <b>CO3-</b> Illustrate the methods involved in production of fermented foods. <b>CO4-</b> Explain and Differentiate between the milk, grain and meat based fermented foods. <b>CO5-</b> Summarize the role of microbes involved in fermentation process and role of probiotics <b>CO6</b> Generalize the concept of different food based fermented products
<b>BMBS 606</b>	<b>Microbiological Analysis Of Air And Water</b>	<b>CO1-</b> Identify and examine air borne microorganisms, Air Sample, Water sample, Control Measures. <b>CO2-</b> Summarize the impact of air borne, water borne pathogens and their impact on human and environment <b>CO3-</b> Determine sampling, collection methods and control measures for air borne and water borne pathogens <b>CO4-</b> Explain air borne and water borne pathogens. <b>CO5-</b> Consider different sampling, collection and control measures for air borne and water borne microorganisms. <b>CO6-</b> Generalize the concept of air and water microbiology.

<b>BMBS 607</b>	<b>Nursery and Gardening</b>	<p><b>CO1-</b> Define the terminology used in Nursery, seed, vegetative propagation and gardening.</p> <p><b>CO2-</b> Discuss about objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants, Seed –Structure, types, and storage and production technology, Vegetative propagation and gardening.</p> <p><b>CO3-</b> Explain about nursery and planting, seed, vegetative propagation and its types and gardening.</p> <p><b>CO4-</b> Explain and differentiate between nursery and gardening, planting, seed, vegetative propagation and its types.</p> <p><b>CO5-</b> Summarize the concept of nursery and gardening</p> <p><b>CO6-</b> Revise about Nursery, seed, vegetative propagation and gardening.</p>
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