

COURSE OUTCOME – UNDERGRADUATE BOTANY HONOURS (CBCS SYSTEM)

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
BSC	2018	COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 1 CC1 [Phycology and Microbiology] (FM 40)	UNIT 1: Introduction to microbial world	Students study categorization, identification, and economic relevance of microbes via theoretical lessons, exercises.
		UNIT 2: Viruses	Students learn about general introduction of virus, life cycle of virus and harmful role of virus.	
		UNIT 3: Bacteria	Students gain practical instruction in microbiological principles, microscopy and staining techniques, and the fundamentals of bacteria.	
		UNIT 4: Algae	Detailed study of algae will enhance the knowledge of the students. Students will understand the ecological importance of algae.	
		UNIT 5: Cyanophyta and Xanthophyta	Students learn about basic concept of different species cyanophyta and Xanthophyta algae and its economic importance.	
		UNIT 6: Chlorophyta and Charophyta	Students learn about basic concept of different species chlorophyta and charophyta algae and its economic importance.	
		UNIT 7: Phaeophyta and Rhodophyta	Students learn about basic concept of different species phaeophyta and Rhodophyta algae and its economic importance.	
		SEMESTER – 1 CC1 PRACTICAL (FM 20)		Students learn life cycles of virus and bacteria and their multiplication processes along with Gram staining and endospore staining techniques.
		SEMESTER – 1 CC2 [BIOMOLECULES & CELL BIOLOGY]	Unit 1: Biomolecules	A basic knowledge of chemical bonds, pH, buffer and the biological macromolecules is included in this unit.

	(FM 40)	Unit 2: Bioenergetics	Students learn about the laws of thermodynamics, free energy concept, chemical reactions and role of ATP as energy currency.
		Unit 3: Enzymes	Structure and properties of enzyme, mechanism of action, kinetics of enzyme catalyzed reactions and enzyme inhibition is included in this unit.
		Unit 4: The Cell	Students get detailed information about the structure and function of a cell, differences between prokaryotic and eukaryotic cell and the endosymbiotic origin of chloroplast and mitochondria in this unit.
		Unit 5: Cell wall and Plasma membrane	Students learn about the structure and chemical composition of cell wall and plasma membrane, their function and the details about membrane transport.
		Unit 6: Cell organelles	Detailed overview of all the cell organelles is included in this unit.
		Unit 7: Cell division	Students get information about the types of cell divisions, cell cycle and its regulation mechanisms.
		SEMESTER – 1 CC2 PRACTICAL (FM 20)	
	SEMESTER – 2 CC3 [Mycology and Phytopathology] (FM 40)	Unit 1: Introduction to true fungi	Students learn about the classification, identification, and economic significance of fungus in theoretical lessons, practice identifying common fungi in practical classes, and identify fungi on local field visits.
		Unit 2: Chytridiomycota and Zygomycota	Learn about different species which enhances knowledge and harmful and beneficial role of this type of fungi.
		Unit 3: Ascomycota	Learn about different species which enhances knowledge and harmful and beneficial role of this type of fungi.

			Unit 4: Basidiomycota	Learn about different species which enhances knowledge and harmful and beneficial role of this type of fungi.
			Unit 5: Allied Fungi	Learn about different species which enhances knowledge and harmful and beneficial role of this type of fungi.
			Unit 6: Oomycota	Learn about different species which enhances knowledge and harmful and beneficial role of this type of fungi.
			Unit 7: Symbiotic associations	Students learn about the symbiotic relationship that occur in nature helps to know that fungi are interdependent and connected to each-other.
			Unit 8: Applied Mycology	Students learn about the fungal importance in agriculture, medicine, food production and the environmental sciences.
			Unit 9: Phytopathology	Agriculture, crop protection, and disease control all have promising prospects in the field of plant pathology.
		SEMESTER – 2 CC3 PRACTICAL (FM 20)		Students study the sexual and asexual stages of fungal specimens through permanent and temporary slides, lichens and histopathological study of phytopathological specimens
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		SEMESTER – 2 CC4 [ARCHEGONIA TAE] (FM 40)	Unit 1: Introduction	Students will have the basic knowledge about the salient features of archegoniates, their origin through transition to land habits.
			Unit 2: Bryophytes	Students will gain the knowledge about the general characteristics of bryophytes, their classification and range of thallus structure.
			Unit 3: Type Studies - Bryophytes	Students will learn bryophytes like <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> , <i>Sphagnum</i> , <i>Pellia</i> , <i>Porella</i> , <i>Funaria</i> , etc. in detail in terms of their morphology, anatomy and reproduction

			Unit 4: Pteridophytes	Students will acquire the knowledge about the group characteristics of pteridophytes, their classification and about early land plants.
			Unit 5: Type Studies - Pteridophytes	Students will learn the details of some pteridophytes like <i>Psilotum</i> , <i>Selaginella</i> , <i>Equisetum</i> , <i>Pteris</i> , etc. regarding morphology, anatomy and life cycle including several other aspects.
			Unit 6: Gymnosperms	Students will understand the characteristics, distribution, economic value and all the basic details of this group including elaborate descriptions of <i>Cycas</i> , <i>Pinus</i> , and <i>Ginkgo</i> .
		SEMESTER – 2 CC4 PRACTICAL (FM 20)		Students will learn to observe the morphology as well as the anatomy of the studied specimens and also to prepare permanent slides of anatomical sections. The educational excursion will assist them to recognize the plants in their natural habitat.

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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 3 CC5 [MORPHOLOGY & ANATOMY OF ANGIOSPERMS] (FM 40)	Unit 1: Introduction and scope of plant morphology and anatomy	Students will learn the scope and significance of morphology and anatomy study regarding the angiospermic plants.
			Unit 2: Structure and development of plant body	Students will have a clear idea relating to the organization of different tissues and their development in plant organs during embryo formation.
			Unit 3: Tissues	Students will gain the knowledge about the detailed structural parts of different kinds of plant tissues and their functions.
			Unit 4: Apical meristems	Students will grasp the knowledge about the organizations of apical meristematic tissues present in root apex and shoot apex regions and different proposed theories in detail.
			Unit 5: Vascular cambium and wood	Students will acquire the knowledge of about cambium tissues responsible for secondary growth, and detailed process of wood formation in dicot plants.

			Unit 6: Adaptive and protective systems	Students will have the basic idea regarding the adaptive features of hydrophytes and xerophytes.
		SEMESTER – 3 CC5 PRACTICAL (FM 20)		Through practical observations, students will learn various morphological attributes of flowers and fruits. Anatomical study of plant organs will provide a clear image regarding the tissue organizations in different plant organs.
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		SEMESTER – 3 CC 6 [Economic Botany] (FM 40)	Unit 1: Origin of cultivated plants	This unit offers informations about the centres of origin of cultivated plants (according to Vavilov’s work), concept of plant introduction, domestication, evolution and importance of germplasm diversity.
			Unit 2: Cereals	Students able to know about the origin, morphology, processing and uses of wheat and rice. They also get informations about small grain cereals or millets.
			Unit 3: Legumes	Students study about origin, morphology and uses of legumes along with their ecological and economic importances.
			Unit 4: Sources of sugars and starches	Students learn about two important sugar and starch sources- sugarcane and potato in terms of their morphology, processing and uses.
			Unit 5: Spices	Students able to gather knowledge about important spices along with the economic importance of fennel, black pepper, clove and saffron.
			Unit 6: Beverages	Students learn about the morphology, processing and uses of two major beverages-tea and coffee.
			Unit 7: Sources of oils and fats	Students get informations regarding several oil yielding plants, extraction of essential and fatty oils from those plants, their differences and commercial applications.

			Unit 8: Natural Rubber	Students learn about tapping, processing and uses of natural rubber.
			Unit 9: Drug-yielding plants	Students develop detailed knowledge regarding several therapeutic and habit-forming drug yielding plants.
			Unit 10: Timber plants	A general account of timber yielding plant is included with special reference to pine and teak.
			Unit 11: Fibers	Students develop knowledge regarding the classification, origin and other informations about cotton, jute and coir.
		SEMESTER – 3 CC 6 PRACTICAL (FM 20)		Students learn to draw habit sketches, transverse and longitudinal sectioning, microchemical tests for detection of specific biomolecules of cereal grains, potato tubers, sugarcane, spices, drug yielding plants, oil yielding plants, beverage yielding plants, legumes and drug yielding plants included in the theory syllabus.
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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 3 CC 7 [GENETICS] (FM 40)	Unit 1: Mendelian Genetics and its Extension	Learn about the basic principles of inheritance, Mendelian principles and non-mendelian gene interactions.
			Unit 2: Extrachromosomal Inheritance	Know about the inheritance pattern which are controlled by organellar genetic material.
			Unit 3: Linkage, crossing over and chromosome mapping	Learn about linked genes and genetic recombination and chromosome mapping techniques.
			Unit 4: Variation in chromosome number and structure	Gain knowledge about chromosome aberration and variation in chromosome number.
			Unit 5: Gene mutations	Learn about mutation and various types of mutations and the potential impacts of mutations.
			Unit 6: Fine structure of gene	Know about the classical and molecular concept of gene structure.

			Unit 7: Population and Evolutionary Genetics	Gives knowledge about the frequencies of alleles and genotypes. It provides a clear understanding of how evolutionary changes occur.
		SEMESTER – 3 CC 7 PRACTICAL (FM 20)		They develop knowledge about Meiosis through temporary squash preparation. Also, gain Practical knowledge of various gene interactions. The study of aneuploidy helps to understand different genetic disorders and syndromes.

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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 3 SEC PAPER 1 [HERBAL TECHNOLOGY] (FM 60)	Unit 1: Herbal Medicines	Students learn the history and scope of herbal medicines, the definitions of medical terms, role of medicinal plants in Siddha medicine, cultivation techniques, harvesting, processing, storage, marketing prospects of medicinal plants.
			Unit 2: Pharmacognosy	This unit helps the students to learn about the medicinal usage of Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.
			Unit 3: Phytochemistry	This unit provides ample knowledge of testing methods of active principles of <i>Catharanthus roseus</i> , <i>Withania somnifera</i> , <i>Clerodendron phlomoides</i> and <i>Centella asiatica</i> .
			Unit 4: Analytical pharmacognosy	Students learn about drug adulteration, types and methods of drug evaluation, biological testing of herbal drugs and phytochemical screening methods of plant secondary metabolites.
			Unit 5: Medicinal plant banks	Students able to know about the micropropagation techniques of medicinal plants, concept of herbal foods and future of pharmacognosy.
		SEMESTER – 3 SEC PAPER 1 PRACTICAL		NIL

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		SEMESTER - 4 CC8 [MOLECULAR BIOLOGY] (FM 40)	Unit 1: Nucleic acids: Carriers of genetic information	Learn about the basic concept of nucleic acids as carriers of genes.
			Unit 2: The Structures of DNA and RNA / Genetic Material	Know about the structure of DNA, RNA, and other organellar genetic materials.
			Unit 3: The replication of DNA	Gain knowledge about DNA replication mechanism in prokaryotes and eukaryotes, different enzymes, and their functions in DNA replication.
			Unit 4: Central dogma and genetic code	Provide knowledge about the basic concept of how genetic information passes from DNA to proteins via RNA.
			Unit 5: Transcription	Learn about the process of mRNA synthesis from DNA. Also, provides knowledge of different transcriptional factors involved in the process.
			Unit 6: Processing and modification of RNA	Know about the processing of RNA after transcription.
			Unit 7: Translation	Gives knowledge about the process of protein synthesis from mRNA, and the different translational factors involved in the process.
		SEMESTER - 4 CC8 PRACTICAL (FM 20)		Develop hands-on training on different molecular techniques. learn about isolation techniques and how to estimate DNA content.

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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER - 4 CC9 [Plant Ecology and Phytogeograph y] (FM 40)	Unit 1 Introduction	This unit help to learn about the basic concept of ecology along with levels of organization, inter- relationships between living word and environment, dynamism and ecological homeostasis.
			Unit 2: Soil	Students able to learn about the origin, importance, formation, composition of soil, soil profiles and the role of climate in soil formation.
			Unit 3: Water	This unit provides detailed understanding of the importance and the status of water in the environment, precipitation types,

			soil water, water table and hydrological cycle.
		Unit 4: Light, temperature, wind and fire	Students study about the variations of these abiotic factors and the adaptation strategies of plants to these variations.
		Unit 5: Biotic interactions	This unit help to learn about the trophic organizations, different biotic interactions, food chain and food web, ecological pyramids and standing crops.
		Unit 6: Population ecology	This unit help to learn about the characteristic features and dynamics of populations and the concept of ecological speciation.
		Unit 7: Plant communities	Students develop knowledge about the concept and characters of community- habitat, niche, ecological amplitude, ecotone, edge effect, community dynamics along with the process of succession in hydrosere and xerosere and climax concept.
		Unit 8: Ecosystems	Students learn about the structure and processes of several ecosystems.
		Unit 9: Functional aspects of ecosystem	This unit offers knowledge about the functions of ecosystem- energy flow, production and productivity, ecological efficiencies, and biogeochemical cycling of mineral nutrients.
		Unit 10: Phytogeography	This unit help to know about the principles of distribution of plants, continental drifts, theory of tolerance, endemic plants, local vegetations, major tropical, temperate and arctic biomes and phtogeographical regions of India.

		SEMESTER - 4 CC9 PRACTICAL (FM 20)		In practical classes, students get familiar with the instruments used to measure microclimate variables, measurement of soil and water pH, determination of dissolved oxygen from water, determination of soil organic and inorganic matter, bulk density, porosity and water infiltration of different soil samples, study of biotic interactions and adaptations, and quantitative study of herbaceous vegetations by quadrat method (area-curve method), which help to elaborate the theoretical knowledge.
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		SEMESTER - 4 CC10 [PLANT SYSTEMATICS] (FM 40)	Unit 1: Significance of plant systematics	Students will know the objectives and importance of plant systematics study.
			Unit 2: Taxonomic hierarchy	Students will learn the basic concept regarding different taxa and taxonomic categories.
			Unit 3: Botanical nomenclature	Students will acquire the knowledge regarding the naming of plants, the rules and other nomenclatural aspects.
			Unit 4: Systems of classification	Students will be familiar with the different classification systems in detail.
			Unit 5: Diagnostic features of families	Students will know different diagnostic characters of angiospermic plant families and common important plants of medicinal and economic values.
			Unit 6: Phylogeny of angiosperms	Students will gain the knowledge of origin and evolution of angiosperms including different methods of illustrating evolutionary relationships.
		SEMESTER - 4 CC10 PRACTICAL (FM 20)		Students will learn to differentiate various angiospermic plant families based on their morphological stable characters and their economic values. They can easily identify different taxa. The field trip will be beneficial for practical observation in their natural habitat and collection of herbarium specimens also.

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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 4 SEC Paper 2 [Nursery and Gardening] (FM 60)	Unit 1: Nursery	Learn about the basic concept, objectives, and scope in the nursery.
			Unit 2: Seed	Learn about the structure and types of seeds, seed dormancy, and seed storage techniques.
			Unit 3: Vegetative propagation	Learn about the various techniques of vegetative propagation like cutting, air layering, and their maintenance.
			Unit 4: Gardening	learn about the objectives and scope in gardening, types, and operations of gardening, etc.
			Unit 5: Sowing/raising of seeds and seedlings	Learn about the maintenance of seeds and seedlings and the cultivation process of various vegetables.
		SEMESTER – 4 SEC Paper 2 PRACTICAL		NIL
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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER - 5 CC11 [MOLECULAR BIOLOGY] (FM 40)	Unit 1: Introduction	Students obtain in-depth information on general history of reproductive biology of angiosperm. The future looks bright for applied forest services, and taxonomy.
			Unit 2: Reproductive development	Both short educational trips and longer ones provide them a thorough understanding of the many reproductive organs and the angiosperm family.
			Unit 3: Anther and pollen biology	Students obtain in-depth information on palaeobotany, and palynology, as well as plant fossils and pollen and taxonomy of angiosperms in Plant systematics, as well as embryology in Angiosperm Reproductive Biology. Students deal with various pollen samples in practical classes and explore various plant fossils from permanent preparations.
			Unit 4: Ovule	Students learn about female reproductive part of a flower and ovules are located inside the ovary. Ovary after fertilization turns into a fruit whereas ovules turn into

				seeds of fruit. An ovule is a structure found inside the ovary of plants. Integuments are the two layers which cover the internal structures of the ovule.
			Unit 5: Pollination and fertilization	Students gain their knowledge on pollination which is the transfer of pollen grains from an anther to a stigma. Pollen can be transferred by an animal or by the wind. Fertilization takes place inside the ovary when the nucleus of pollen grain fuses with the nucleus of an ovule to produce a zygote.
			Unit 6: Self incompatibility	Students learn about the inability to produce zygotes after self-pollination in a fertile hermaphrodite plant, which has stamens and pistils in the same flower. This structural organization of the hermaphrodite flower increases the risk of self-pollination, leading to low genetic diversity.
			Unit 7: Embryo, Endosperm and Seed	Student gain in depth knowledge on seed development begins with the formation of endosperm and embryo from the fertilized central cell and the fertilized egg cell (zygote), respectively. Although possessing the same genetic information, the triploid endosperm and the diploid embryo develop towards distinct destinations.
			Unit 8: Polyembryony and apomixis	Students learn about the formation of many embryos from one fertilized egg and asexual reproduction wherein the production of seeds occurs without fertilization.
		SEMESTER - 5 CC11 PRACTICAL (FM 20)		Students gain practical knowledge about morphology and anatomy of anther, pollen, ovule, types of female gametophyte and endosperm, process of pollination and embryogenesis.
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		SEMESTER – 5 CC12 [PLANT PHYSIOLOGY] (FM 40)	Unit 1: Plant-water relations	This unit help students to gather knowledge regarding water potential, absorption of water by roots, pathways of water movement inside plants, theories

				proposed to explain ascent of sap, mechanism and factors affecting transpiration.
			Unit 2: Mineral nutrition	Students learn about essential and beneficial nutrients for plants, criteria for essentiality, macro and micro nutrients-their role and deficiency symptoms, nutrient solutions-their role and methods of study, and role of chelating agents.
			Unit 3: Nutrient Uptake	Students able to know about the role of soil as nutrient reservoir, ion transport mechanisms- active and passive transport, role of ATP, role of carrier proteins and ATPase, different types of ion transport.
			Unit 4: Translocation in the phloem	Students learn about the experimental evidence in favour of phloem as a site of sugar translocation, pressure-flow model, mechanism of phloem loading and unloading and source-sink relationship.
			Unit 5: Plant growth regulators	In this unit, students study the discovery, chemical nature, bioassay and physiological roles of several important plant growth regulators.
			Unit 6: Physiology of flowering	Students learn the concept of photoperiodism, vernalization, florigen and the nature of flowering stimulus along with the mechanism and significance of seed dormancy.
			Unit 7: Phytochrome, cryptochromes and phototropins	This unit provides informations about the discovery, chemical nature, and function of Phytochrome, cryptochromes and phototropins in terms of photomorphogenesis. Students also learn about the mode of action of low energy responses (LER) and high irradiance responses (HIR).
		SEMESTER – 5 CC12 PRACTICAL (FM 20)		Students get hands on experience on the determination of osmotic potential, water potential, effect of light intensity and wind velocity on transpiration, calculation of stomatal frequency and stomatal index, area of open stomata, study of seed germination, study of IAA bioassay, amylase activity in germinating seed. Students also learn the experiments on demonstration of suction, fruit ripening, rooting, bolting experiment, <i>Avena</i> coleoptile bioassay.

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		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 5 DSE Paper 1 [Plant Breeding] (FM 40)	Unit 1: Plant breeding	Students will know the objectives and importance of breeding systems in crop plants.
			Unit 2: Methods of crop improvement	Students will understand different methods of crop improvement, like vegetative propagation, hybridization in self and cross-pollinated plants.
			Unit 3: Quantitative inheritance	Students will acquire the knowledge regarding the concept and mechanism of quantitative inheritance along with examples.
			Unit 4: Inbreeding depression and heterosis	Students will be familiar with the term heterosis and inbreeding depression, its causes, genetic basis, and applications.
			Unit 5: Crop improvement and breeding	Students will have the concept regarding the role of polyploidy, mutations and overall biotechnology in crop improvement through breeding.
		SEMESTER – 5 DSE Paper 1 PRACTICAL (FM 20)		Students will learn to perform artificial pollination, emasculation and hybridization in self and cross-pollinated crops. They will gain the knowledge of statistical data interpretation.
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		SEMESTER – 5 DSE Paper 2 (Horticultural Practices and Post-harvest Technology) (FM 40)	Unit 1: Introduction	For the students, these specialized courses help create new opportunities. They learn about the practical aspects of plant sciences. Demonstrate a working knowledge and appreciation of the diversity of plants, their culture and utilization.
			Unit 2: Ornamental plants	To increase production and productivity of vegetable crops. To increase production and productivity of spices crops. To establish nurseries both at public & private sector for quality planting materials. To transfer technologies from Lab to Land.
			Unit 3: Fruit and vegetable crops	The main objective of fruit and vegetable processing is to supply wholesome, safe, nutritious and acceptable food to consumers throughout the year. Fruits and

				<p>vegetables also supply vitamins and minerals to the diet and are sources of phytochemicals that function as antioxidants, phytoestrogens, and anti-inflammatory agents.</p>
			Unit 4: Horticultural techniques	<p>The main aim of horticulturist is to improve the plant growth, quality, nutritional value, yield and resistance to insects, diseases, and environmental stresses. A horticulturist is also involved in the research work that includes research on plants to produce new generations.</p>
			Unit 5: Landscaping and garden design	<p>Familiarization with principles and practices of landscaping and ornamental gardening. Landscape designs, its principles and practices of landscaping and ornamental Gardening structure, features, styles of garden, types of gardens: English, Mughal, Japanese, Persian, Spanish, Italian, Vanams, Buddha garden, Popular gardens of India.</p>
			Unit 6: Floriculture	<p>Students will learn about floral structure and why flowers are important to pollination and reproduction. They will do a flower dissection and drawing, labeling the parts of the flower in order to learn the structure of a plant reproductive system. Students will be able to draw and label a flower.</p>
			Unit 7: Post-harvest technology	<p>Students learn the excellent quality of the produce (color, taste, flavor, aroma). To increases the shelf life of the crops. To keep the fruits or vegetables or commodities free from insects and pests. To get vegetables and fruits fresh all year round.</p>
			Unit 8: Disease control and management	<p>Students gain their knowledge to use different chemicals, physical and biological control mechanism how to reduce the pathogen.</p>
			Unit 9: Horticultural crops - conservation and management	<p>It gives idea about Prolonged post-harvest storage life of horticultural commodities and increase income through value addition of the products and to reduce post-harvest losses.</p>
			Unit 10: Field trip	<p>Its gives students the chance to understand how they can apply the things they've learned to a real situation.</p>

		SEMESTER – 5 DSE Paper 2 PRACTICAL		Students get practical knowledge about the importance of light and chlorophyll in photosynthesis, pigment identification, vegetative propagation techniques, plant movements, analysis of soil organic matter and mineral nutrients, histopathological studies of diseased crops and field visits for disease diagnosis.
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		SEMESTER - 6 CC13 [Developmental Biology] (FM 40)	Unit 1: Concept of metabolism	Learn about the basic concept of anabolic and catabolic pathway and the regulation of the metabolic pathway.
			Unit 2: Carbon assimilation	Learn about the relationship between light and photosynthesis and the relationship between carbon dioxide and photosynthesis.
			Unit 3: Carbohydrate metabolism	Learn about the process of carbohydrate synthesis after the carbon assimilation in plants.
			Unit 4: Carbon Oxidation	Learn about the process of carbohydrates breakdown for production of energy in the form of ATP and release of CO ₂ as byproduct.
			Unit 5: ATP-Synthesis	Know about the electron transport chain and the process of ATP synthesis.
			Unit 6: Lipid metabolism	Learn about the process of synthesis and breakdown of lipids.
			Unit 7: Nitrogen metabolism	Gives knowledge about nitrogen assimilation, biological nitrogen fixation, and the biochemistry of nitrogen fixation.
			Unit 8: Mechanisms of signal transduction	Learn about how cells respond to various cell signals.

		SEMESTER - 6 CC13 PRACTICAL (FM 20)		Practical experiments help to understand different theoretical concepts related to photosynthetic pigments, the effect of light and carbon dioxide in photosynthesis, the rate of respiration, etc.
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		SEMESTER - 6 CC14 [Plant Biotechnology] (FM 40)	UNIT 1: Plant Tissue Culture	Students gain their knowledge on major industrial importance in the area of plant propagation, disease elimination, plant improvement, and production of secondary metabolites.
			UNIT 2: Recombinant DNA technology	Students learn to illustrate creative use of modern tools and techniques for manipulation and analysis of genomic sequences. To expose students to application of recombinant DNA technology in biotechnological research. To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
			UNIT 3: Gene Cloning	Students obtain in depth knowledge about on method of gene cloning is useful in studying the structure and function of genes in detail.
			UNIT 4: Methods of gene transfer	Gene transfer approaches enable studies to determine how or whether proteins encoded by the transferred gene alter the cell function.
			UNIT 5: Applications of Biotechnology	To understand principles of animal culture, media preparation. To describe meristem culture and clonal propagation of plants on a commercial scale. To describe commercial production of fuels,

				microbial enzymes. To explain the microbial degradation of pesticides, Bioremediation & Bio fertilizers.
		SEMESTER - 6 CC14 PRACTICAL (FM 20)		Students get hands on experience on media preparation, sterilization, several tissue culture techniques, restriction digestion, plasmid DNA isolation and other related biotechnological experiments.
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		SEMESTER - 6 DSE Paper 3 [Industrial and Environmental Microbiology] (FM 40)	Unit 1: Scope of microbes in industry and environment	In this unit, student learn the prospects of microorganisms in industry and environment.
			Unit 2: Bioreactors/Fermenters and fermentation processes	This unit help students to learn about different types of fermentations, components and types of bioreactors used in industry.
			Unit 3: Microbial production of industrial products	Students get detailed idea about the microbes used, fermentation media, downstream processing and techniques of harvesting along with hands on training on fermentation processes of enzymes, antibiotics, alcohol and organic acids.
			Unit 4: Microbial enzymes of industrial interest and enzyme immobilization	Students study about the industrial applications and hands on training of microbes for hydrolysis of casein, starch and cellulose, methods of immobilization of enzymes along with its advantages and industrial applications.
			Unit 5: Microbes and quality of environment	Students learn the distribution and isolation procedures from air, soil and water.
			Unit 6: Microbial flora of water	This unit provides knowledge about water pollution, role of microbes in wastewater treatment, role of microbes as bioindicators of water, and determination of BOD, TDS and TOC of water.
			Unit 7: Microbes in agriculture and remediation of contaminated soils	Students develop knowledge about the significance of microorganisms in biological fixation of nitrogen and other nutrients, role of mycorrhiza, bioremediation and isolation techniques of root nodule bacteria and mycorrhizal colonization.

		SEMESTER – 6 DSE Paper 3 PRACTICAL (FM 20)		In the practical, students learn the details about the working principles and functioning of instruments in microbiology laboratory. They also get acquainted with the hands-on sterilization techniques and media preparation.
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		SEMESTER - 6 DSE Paper 4 [BIOSTATISTICS] (FM 40)	Unit 1: Biostatistics	Learn about the basic concept of statistical methods, measurements, and their applications.
			Unit 2: Collection of data- primary and secondary	Learn about the types and methods of data collection and sampling techniques.
			Unit 3: Measures of central tendency	Learn about the statistical analysis (mean, mode, median, standard deviation) to get a single value that describes the characteristic of the entire mass of data.
			Unit 4: Correlation	learn about statistical analysis for measuring the degree of relationship between two variables.
			Unit 4: Correlation	learn about statistical analysis for measuring the degree of relationship between two variables.
		SEMESTER - 6 DSE Paper 4 PRACTICAL (FM 20)		Gain practical knowledge of data collection methods and sampling techniques, calculation of mean, mode, median, standard deviation, determination of correlation coefficient value, F-value, etc.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
BSC	2018	COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 1 & 3 GE 1 & 3 PAPER 1 [Biodiversity (Microbes,	Unit 1: Microbes	Students will gain the basic knowledge about the general characteristics, diversity, distribution, structure and reproduction of various microorganisms.

		Algae, Fungi and Archegoniata] (FM 40)	Unit 2: Algae	Students will be familiar about different algal groups, range of their thallus structure and economic importance.
			Unit 3: Fungi	Students will acquire the basic concept of structure, reproduction and life cycles of different fungi along with their several symbiotic associations.
			Unit 4: Introduction to Archegoniate	Students will have the knowledge about archegoniate and their characteristics including transition history to land habits.
			Unit 5: Bryophytes	A detailed account of general characteristics, morphology, habitat, life cycles depicting alternation of generation of bryophytes can be provided.
			Unit 6: Pteridophytes	Students will have the knowledge of different Pteridophytic plants, their diversity, distribution, reproduction details and economic values.
			Unit 7: Gymnosperms	Students will learn about gymnospermic plant groups, their characteristics, ecological significance, economic value, morphology, anatomy, reproduction etc.
		SEMESTER – 1 & 3 GE 1 & 3 PAPER 1 PRACTICAL (FM 20)		Students must have gained the concept of different plant groups, their structural differentiation, anatomical features, and reproductive structures in both external and sectional views.

NAME OF THE PROGRAMME	YEAR OF INTRODUCTION	COURSE OUTCOME		
		COURSE	COURSE NAME	COURSE OUTCOME
		SEMESTER – 2 & 4 GE 2 & 4 PAPER 3 [PLANT ANATOMY AND EMBRYOLOGY] (FM 40)	Unit 1: Meristematic and permanent tissues	Students will gain the basic concept of different tissues present in root and shoot apex, details regarding simple and complex tissues.
			Unit 2: Organs	Students will be familiar with different types of tissues prevailing in root, stem and leaf of dicot and monocot plants.
			Unit 3: Secondary Growth	Students will have the basic knowledge regarding vascular cambium, it's seasonal activity and secondary growth occurred in root and stems.

			Unit 4: Adaptive and protective systems	Students will learn the different adaptive features found in xerophytes and hydrophytes.
			Unit 5: Structural organization of flower	Students will gather information about different structural organizations of flower in detail.
			Unit 6: Pollination and fertilization	Students will gain the detailed knowledge of pollination and fertilization mechanisms found in different angiospermic plants.
			Unit 7: Embryo and endosperm	Structure of embryo, endosperm and their relationship will be discussed for both monocot and dicot angiospermic plants.
			Unit 8: Apomixis and polyembryony	Students will know the term apomixis and polyembryony along with their types and practical applications.
		SEMESTER – 2 &4 GE 2 & 4 PAPER 3 PRACTICAL (FM 20)		Students will perform the sections and may observe the internal tissue organizations practically. They will develop the knowledge for differentiation of root, stem and leaf. Moreover, they develop a clear idea regarding floral external and internal structures, involved in pollination and fertilization mechanisms.