

Programme: B.Sc. Agriculture**Programme Code:** 102**Course Summary**

Duration: 4 years

Eligibility

10+2 with minimum 45% marks in aggregate with PCB/ PCM/Agriculture.

Programme Outcomes:

- To get acquaintance with basics and principles of Elementary Statistics, Computer, English, Rural Sociology & Educational Psychology, Elementary Agriculture, Plant Biochemistry, Microbiology.
- To understand the fundamentals of Principles of Agronomy, Soil Science, e.g. Chemistry, soil fertility and nutrient management, Environmental Science, Horticulture.
- To learn the Control of Weed Management in different agricultural and horticultural crops.
- To understand the effect of meteorology on crops production and weather forecasting models which are helpful for prediction of Indian weather conditions?
- To gain the preliminary knowledge of genetic principles and thereby implementing for breeding of field crops.
- To learn the basic concepts of plant pathology for best growth of crops against the prevalent crop diseases of particular crop-zones.
- To develop the Principles and skills of vegetable production, fruit production, ornamental plants and medicinal & aromatics plants.
- To learn principles and techniques of field crops (Kharif & Rabi) production in diverse agroclimatic conditions of India.
- To learn the different methods of irrigating field crops, horticultural crops and managing water as precious element of crop production and increasing water use efficiency.
- To develop skills to conduct various field based activities related to agricultural aspects.
- It imparts the general ideas for the allied aspects of agriculture like Mushroom production, Beekeeping, Sericulture and Lac cultivation.
- To understand and gain the preliminary knowledge for plant biotechnology, establishment of tissue culture lab., generation of transgenic plants.
- To learn the basic concepts of agriculture co-operation, finance and business management related to agriculture products, it gives knowledge for availing different types of agriculture credits by Institutional and non-institutional sources.
- To learn the basic principles and techniques for control of insects, pests on cereals, sugar crops, fruit crops, vegetable crops, plantation crops, stored grain and house hold pests.
- It provides the in-depth knowledge for breeding and nutritional aspects for increasing the production of livestock products like milk, meat, egg, and its by-products and controlling livestock, poultry diseases.
- To learn the in-depth information of crop physiology for augmenting crop productivity. Physiology of growth and development, growth regulators which influence productivity of major cereals, pulses and oilseed crops.
- It provides general idea about the farm machinery which includes sources of farm power, tillage equipments, plant protection equipments, harvesting and threshing machineries, different types of tractors etc.

- To gain the knowledge of extension education different extension and rural development related programmes to understand extension training centres etc.
- To gain the knowledge and applying the principles and practices for different processing techniques for fruits and vegetables after their harvest and increasing their shelf life.
- To learn the principles and practices of farming systems and sustainable agriculture by using LEISA and HEISA. Using different conservation and management practices for soil & water resources.
- It provides basic knowledge for soil survey, soil taxonomy and the role of remote sensing in agriculture.
- The skills for seed production, seed storage, seed testing for purity, viability, moisture and germination related to field crops.
- After learning and imbibing the technical and articulated aspects of agriculture production students' undergoe Rural Agriculture Work Experience (RAWEx) of any four components of their choice wherein students gets exposure in real field experience.

Course outcomes of B.Sc. Agriculture programmes:

Sr.No.	Course name	Credits	Course outcome
1st Semester			
1	Elementary Statistics	1+1	<p>To learn about Introduction to statistics, arithmetic mean, median, mode and partition values range, interquartile range, quartile deviation, mean deviation, variances, standard deviation, coefficient of variation, moments, skewness, Kurtosis and its measure.</p> <p>To gain knowledge of Simple problems based on probability theory; Definition of correlation; Scatter diagram; Karl pearson's coefficient of correlation; Linear regression equations; introduction to test of significance, one sample and two sample test for mean.</p>
2	Agriculture Meteorology	1+1	<p>To understand the basic concepts of Earth atmosphere its composition, extent and structure; Atmospheric weather variables: Atmospheric pressure, its variation with height; Daily and seasonal variation of wind speed and direction. Cyclones and anticyclones, air masses and fronts.</p> <p>To receive knowledge about Agriculture and weather relations: Modification of crop microclimate, use of weather data for irrigation scheduling, pesticides sprays, fertilizer application, climatic normals for crop production. Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave and thermal radiation, net radiation, albedo, atmospheric temperature – temperature inversion, daily and seasonal variation of temperature balance of earth;</p> <p>To understand the concept of atmospheric humidity; saturation, vapour process of condensation, formation of dew, fog, mist, frost, snow rain and hail: precipitation cloud formation and movement.</p>
3	Computer Application	1+1	<p>To learn Introduction to personal computer, peripherals, operating systems (Dos & Windows) and high-level language- Interaction with software pack-ages (Lotus, Foxpro, Statistical, packages) and its execution for applications in relation to solution of simultaneous equations, plotting of graph and diagrams. Simple agricultural statistics computations. Database file; creation and Query.</p>
4	Str. & Spoken English	1+1	<p>To understand the structural patterns of communicative grammar; modern usages; functional language disorder and common structural errors in part of speech-noun, pronoun, verb, adjective, adverb, preposition, conjunction; articles; word-formation and vocabulary building-affixes, prefixes, suffixes, synonyms, antonyms, substitutions and foreign words; prepositions; phrases idioms; gerunds; participles; infinitives; time and tense; modal verbs, conditional parities; synthesis; transformation controlled writing; paragraph writing;</p> <p>To learn and make use of modern technical prose; listening and reading skills; comprehension; phonetic and scientific systems of spoken English – speech mechanism; symbols and sounds; stress and intonation.</p>
5	Elementary Agriculture	2+1	<p>To learn about the basic concepts of Indian agriculture its scope and resources; crop plants-their significance as source of food, feed, fuel and raw material for various industries. Crop seasons and classification of crops according to seasons.</p> <p>To understand the basic concepts of Soils-their formation, classification, physical and chemical properties and</p>

			<p>manures and fertilizers-essential plant nutrients, uptake of N,P & K by important crops, methods of manure & fertilizer application, composition of bulky organic manures, concentrated organic manures, green manures and various types of inorganic fertilizers,</p> <p>To learn about Irrigation and drainage-importance of water, quality of irrigation water; sources methods and measurement of irrigation water, disadvantages of excessive soil moisture necessity and methods of drainage.</p> <p>The students will be able to understand cultivation of important crops in the state such as wheat, rice cotton, sorghum, maize, groundnut, rape seed & mustard, chickpea, pigeonpea, tobacco, berseem, potato and sugarcane. Acquaintance with horticultural crops such as cabbage, cauliflower, onion, garlic, cucurbits, root crops, peas, tomato, brinjal, banana, apple, mango, litchi, citrus, guava.</p> <p>The students will be able to understand the concepts of introductory economics-Factors of production, exchange, different types of markets; pricing, bank and credits, law of diminishing returns, elementary rural sociology, place of agriculture in five year plans, statistics relating to agricultural production.</p> <p>The students will be able to explain of main breeds of animals such as cows, buffaloes, goats, sheep and poultry. Elementary physiology and anatomy of cow and buffaloes. Characteristics of milch cattles. Care of animal, poultry management, principles of nutrition, common medicines.</p> <p>The students will be able to learn types of iron and steel used in agricultural implements; different types of plough, mechanical devices, their management and cost. Water lifting devices, tillage, different methods of ploughing. Power transmission through belts, pullies, gears, chaff, cutter, cane crusher. Necessity for drainage, damage to soil due to excess moisture, land development, prevention and formation of acidic and alkali soils.</p>
6	Principles of Agronomy	2+1	<p>The students will be able to understand the Principles of agronomy as a science and its scope.</p> <p>The students will be able to quantify and explain the plant growth and development, environmental effects on growth, ideal plant type, tillage, seed quality, sowing, crop density and spatial arrangement, crop nutrition, organic manures and fertilizers, irrigation and drainage, The students will be able to understand weed management, distribution of crops, cropping systems, selection of crops and varieties for multiple cropping, crop yield contributing characters;</p> <p>The students will be able to understand the organic farming-concept, practice and scope in India. Crop production in dry lands, salt affected, acidic, flood affected, waterlogged and eroded areas.</p>
7	Rural Sociology & Educational Psychology	2+1	<p>The students will be able to explain the concepts, methods, tools, characteristics of rural society and people; rural – urban continuum and differences, Rural social structure: interaction, processes, institutions groups.</p> <p>The students will be able to understand rural social stratification: status, roles, class, castes etc. Panchyati Raj and Block Development Organizations as rural peoples participative agencies for planned development, Specific, programs for rural area upliftment/ employment: JRY, IAT, EAS, MWS, IRDP, GKY, DWCRA, TRYSEM, DPAP, DDP, NSAP, Land reforms, etc. Council for Advancement of peoples Action and Rural Technology</p>

			(CAPART), National Fund for Rural Development (NFRD), NGOs/Voluntary Sector. The students will learn about Conceptual /Clarifications on educational psychology, Psychology of individual differences; MA & IQ; the gifted, Slow Learner and Socially disadvantaged child. Learning and motivation, mental hygiene and adjustment, guidance and counselling.
2nd Semester			
8	Fundamentals of Soil Science	2+1	The students will be able to understand soil as a natural body and medium for plant growth; soil compounds and soil plants relationship; soil forming rocks and minerals; weathering and processes of soil formation; The students will be able to explain physical properties of soils – texture, structure, density and porosity, soil colour, consistence and plasticity, soil reaction pH and its measurement, soil acidity and alkalinity, buffering, effect of pH on nutrient availability, soil colloids – inorganic and organic; silicate clays: constitution and properties; humic substances nature and properties; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and influence on soil properties, transformation of organic and inorganic constituents of soil; biological nitrogen fixation; recycling of organic wastes in soils – Urban and industrial wastes. Students will be able to describe Soil water retention, dynamics and availability; soil air composition and dynamics; source, amount and flow of heat in soils; soil temperature and plant growth; soil survey and classification, soils of India. Students will be able to describe soil pollution – behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.
9	Fundamentals of Horticulture	2+1	To learn about fundamentals of horticulture: its definition and branches; importance and scope; horticultural and botanical classification; climate, soil and distribution of fruit crops. Students will be able to learn the techniques of propagation and nursery raising; principles of orchard establishment and management. flower bud differentiation and pollination; causes of unfruitfulness, pollinizers and pollinators. Students will be able to explain environmental and soil factors affecting vegetable production, kitchen gardening; garden types and parts; care and maintenance of ornamental plants; lawn. making; knowledge of landscaping of rural and urban areas; exposure to important medicinal aromatic plants, spices and condiments, use of plant bio-regulators in horticulture, Post Harvest Technology-Principles and Practices.
10	Elementary Plant Biochemistry	2+1	Students will be able to understand recapitulation of basic chemistry and biology, water, pH and buffer, Cellular constituents: Structure and function – amino acids and protein, carbohydrates, lipids and biomembrances and nucleic acids; Students will be able to explain enzymes-function, properties and mechanism, metabolism of cellular

			<p>constituents: Central Metabolic Pathways: Degradative path ways – glycolysis, hexose monophosphate pathway, degradation of starch, sucrose, other sugars, fatty acids and acylglycerols, proteins and amino acids; Biosynthetic pathways – photosynthesis, formation of sucrose and starch, Kreb’s cycle and electron transport chain;</p> <p>To learn Nitrogen and sulphur cycles; Nitrogen fixation, assimilation of ammonia; Synthesis of DNA, RNA and proteins; Secondary metabolites – structure, function and metabolism</p>
11	Weed Management	1+1	<p>Student will learn weed control, costs to society from weeds, classification of weeds. Ecology of weeds: Reproduction (seed production, seeds dissemination, seeds germination, vegetative reproduction), geographics, distribution, factors influencing weed distribution, weed succession of uncultivated sites, competition between crops and weeds. Concepts of prevention, eradication and control.</p> <p>Students will be able to manage weeds by controlling different methods: Physical, cultural, biological, chemical, integrated weed management.</p> <p>Students will get exposure to herbicides: basic concepts, polar vs. Non-polar, Esters, Salts, acids, etc. surfactant chemistry. Factors influencing foliage active herbicides: reaching the target plant, spray retention, absorption into leaf, translocation, factors influencing soil applied herbicides: microbiological effect, soil absorption, photo-decomposition and volatilization, spray of herbicides.</p>
12	Element of Genetics	2+1	<p>Students will get exposure to the historical aspects of Pre Mendelian and post-Mendelian concepts of heredity, Mendelian principles of heredity, Probability and chi-square.</p> <p>Students will learn concepts of Cell plant cell and animal cell, chromosome structure. Cell division mitosis, meiosis, variation in chromosomes polytene chromosome, Lampbrush chromosomes. Dominance relationship gene interaction. Multiple alleles, pleiotropism and pseudoalleles. Sex determination and sex linkage, sex limited and sex influenced traits. Linkage, Crossing over mechanism, Chromosomes mapping, structural changes in chromosomes: Deletion and Duplication, Translocation and inversion, “Numerical changes in chromosomes, chemical basis of heredity”.</p> <p>Students will learn the gene concept mode of replication of genetic material, transcription and translational mechanism of genetic material. Gene regulation and operon concept. Mutations: chemical and physical mutagens, mode of action of mutagens. Extracellular inheritance. Polygene and quantitative inheritance. Introduction to plant tissue culture.</p>
13	Introductory Entomology	2+1	<p>Students will be able to understand the scope of Entomology, brief history of entomology in India, insects as Arthropods and its relationship with phylum Annelida and other classes of Arthropoda, origin in insects major points related to dominance of insects in Animal Kingdom.</p> <p>Students will learn external morphology and anatomy of grass hopper; body segmentation, integument, thorax and abdomen, antennae, legs and wings and their modifications, generalized mouth parts and their modifications, Alimentary, Circulatory, Excretory, Respiratory, Reproductive and nervous systems, major sensory organs like simple and compound eyes chemoreceptors, endocrine glands; basic embryology and post embryonic development, basic groups of present day insects with special emphasis to orders and families of agricultural</p>

			importance like Orthoptera; Tetigonidae, Gryllidae, Gryllotalpidae, Acrididae, Dictyoptera; Mantidae, Blattidae; Isoptera; Hemiptera; Pentatomidae; Coreidae; Cimicidae, Cicadellidae, Delphacidae, Lophophidae, Aleurodidae; Aphididae; Coccidae; Thysanoptera, Coleoptera. Carabidae, Meloidae, Coccinellidae, Bruchidae, Chrysomelidae, Curculionidae, Cerambycidae; Diptera; Culicidae Cephritidae, Agromyzidae, Muscidae; Lepidoptera, Pteridae; Papilionidae, Hespirlidae, Sphingidae, Noctuidae, Artilidae, Pyralidae, Saturnidae, Bombycidae; Hymenoptera. Tenthredinidae, Braconidae, Chalcididae, Trichogrammatidae.
	Introductory Plant Pathology	2+1	<p>Students will be able to understand the importance of plant diseases, scope and objectives of plant pathology concept of plant disease, of cause of plant disease, inanimate causes and plant viruses.</p> <p>Students will be able to explain classification of plant diseases. Definition and terms, parasites, pathogens biotrophs, heribiotrophs, necrotroph, pathogenicity, pathogene is virulence, infection primary infection, inoculum, invasion and colonization, inoculation potential, symptoms, incubation period, disease cycle, disease syndrome, single cycle disease, multiple cycle, single cycle period, multiple cycle disease, alternate host collateral host, predisposition, biotype, symbiosis, mutualism, antagonism.</p> <p>Students will be able to explain history of plant pathology with special reference to Indian work. Pathogenesis and parasitism, Koch's postulate. Effect of pathogenesis on the plants, morphological changes, physiological changes, symptom of plant diseases. Development of identities. Principles and methods of plant disease management.</p> <p>Students will be able to understand the basic concepts of avoidance, exclusion, eradication, disease resistance and therapy. Methods of plant disease management. Genera morphology, characters of fungi and somatic structure, reproduction of various structure.</p> <p>Students will learn Basic and different methods of classification of fungi, taxonomy and nomenclature. Study of selected genera, <i>Plasmodiophora</i>, <i>spongospora (myconycota)</i>, <i>Synchitrum</i>, <i>Thyseoderma</i>, <i>pythium phytophthora</i>, <i>albugo selerophthora</i>, <i>periosdocrospora and percnosi on (Mastigomyccinal)</i>; <i>Taplrina</i>, <i>Erisyphe</i>, <i>Claviceps</i>, <i>Sclerotinia (Ascomycocina)</i>, <i>Puccinia Melarapsora</i>, <i>Uromyces</i>, <i>Ustillgo</i>, <i>Tilletia</i>, <i>Neovosain</i>, <i>Splacelothera</i>, <i>Telyposporium (Besidiomycotina)</i>; <i>Collectotrichum Alternate Cercospora</i>, <i>Fusarium</i>, <i>Helmilthosporium</i>, <i>Pyricularia</i>, <i>Seletorian</i>. <i>Rhizoctonia</i>, <i>Phyllostica</i>, <i>Phoma (Deuteromycotina)</i>. General morphological and cultural characters of prokaryotes (bacteria), basic methods of classification taxonomy and nomenclature. Nutrition and effects of physiochemical factor on growth, reproduction and life cycle genetics and variability.</p> <p>Students will be able to understand the importance and general original characters of morcoplasms, spiroplasma and fastidions bacteria. Reproduction nomenclature and classification physical architecture and chemical composition of viruses and viroids, nomenclature and criteria for identification, multiplication, transmission and infective nature. General morphological characters, life cycle and reproduction of nematodes, behaviour in soil and nematodes as vectors for other plant pathogens. Classification and general identifying characters of phanerogamic plant parasite reproduction and life-cycle.</p>
15	Microbiology	1+1	The student will learn microbial world history- History of microbiology prokaryotic and eukaryotic microbes,

			<p>their cell structure, genetics distribution in nature and importance in agriculture, microorganisms in soil fertility and crop production; carbon, nitrogen, phosphorus and sulphur cycles, plant microbes association symbiotic associative and a symbiotic nitrogen fixation, Azolla and mycorrhiza biodegradation of agricultural chemicals pesticides, herbicides and agricultural organic wastes.</p> <p>The students will learn microbiology of milk and milk products, rural microbiology and silage production; Microbes in human welfare biofertilizers, biopesticides, waste treatment and recycling; composting, ethanol production, antibiotic production, Human and plant pathogenic microbes</p>
3rd Semester			
16	Vegetable Production	2+1	<p>Students will be able to understand the importance of vegetables in human nutrition and national economy, factors affecting vegetable productivity viz. light, temperature, moisture, oxygen, CO₂ mineral nutrients, soil reaction, disease and insect pests; types of vegetable farming; types of classification of vegetable viz, botanical, classification, based on color: mandarin, parts used duration of crop; weed management, use of bioregulation seed production, harvesting and marketing.</p> <p>Students will be able to understand the cultivation practices viz. time of sowing nursery management, transplanting, sowing/planting distance, recommended cultivars seed rate, manure and fertilizers doses, harvesting, storage, physiological disorders, diseases and insect pests and their control measure of various vegetable crops namely potato, tomato, onion, garlic, okra, sweet corn pea, beans, cucurbitaceous crops-pumpkin, bottle gourd, sponge gourd, ridge gourd, pointed gourd, bitter melon, cucumbers etc.</p>
17	Irrigation Water Management	2+1	<p>Students will be able to know the water resources of India, source of irrigation, irrigation water demand, supply and resources development of irrigation, soil moisture and its characteristics soil water potential, retention and movement of soil water. Water intake and infiltration. Importance of water in plants life, plant water status, absorption, transportation and transpiration, moisture sensitive stage, water availability and nutrient uptake. Scheduling of irrigation based on soil moisture status. Physiological stages of crop and meteorological parameters, irrigation under limited water supply conditions. Methods of irrigation; surface irrigation, flooding, furrow, border and basin irrigation. Irrigation; drip and sprinkler irrigations.</p> <p>Students will be able to explain water stress and plant growth effect of water stress on physio-morphological characteristics and productivity of plant, deficit irrigation and strategy for optimizing yield. Water quality standards and its suitability for irrigation, water use efficiency, agronomic technique to boost water use efficiency, factors affecting water use-efficiency.</p> <p>Students will be able to understand irrigation management in soils with low intake rate, saline and alkali soil, soil with shallow ground water table and in poorly drained soil. Water requirement of crops, factors affecting the water requirement of crops, method of determining water requirement, effective rainfall, transpiration and potential evapotranspiration and consumptive use. Irrigation of principal crops critical stages of crops, depth and schedule of irrigation, reducing irrigation requirement of major crops.</p>
18	Principles of Plant Breeding & Breeding of	3+1	The students will get exposure to historical development of plant breeding plant breeding concept, nature and role of plant breeding major achievements and future prospects, genetics in relation of plant breeding, modes of

	Field Crops		<p>reproduction, self-incompatibility and male sterility. Plant Breeders materials domestication, centres of origin, centres of density acclimatization and components of genetic variation and heritability.</p> <p>Student will be able to explain breeding methods in self-pollinated crops: Introduction, selection pure line theory, multilane varieties, hybridization techniques and handling of segregating populations, Hardy-Weinberg law, Methods of breeding cross pollinated crops system of mating heterosis and inbreeding depression development of inbred lines and hybrids and synthetic varieties, breeding methods in asexually propagated crops, clonal selection and hybridization polyploidy in relation to plant breeding, mutation breeding methods, uses nature of gene mutation mutagenic agents, induced mutation in plant breeding, breeding for important biotic and abiotic stresses, and use of biotechnology implant breeding, procedure for release of new varieties.</p> <p>The students will learn concepts of crop systematic, species relationship, floral biology and inheritance of economically important characters, breeding objectives development of varieties with desired yield, adaptability, stability, disease and pest resistance and quality (Physical, chemical, nutritional) and marketing Important varieties along with parentage and characteristics, future thrust area in varietals improvement in crops like wheat, rice, make, soybean, field-pea, pigeon pea, urd bean and rapeseed mustard, sunflower, groundnut, sorghum, sugarcane, potato, cotton and tobacco.</p>
19	Soil Fertility and Nutrient Management	2+1	<p>The students will get exposure to the history of plant nutrition and soil fertility, soil fertility and productivity, problems of soil fertility in India, plant growth and development, factors affecting plant growth; essential plant nutrients, their role and deficiency and toxicity symptoms; Ion exchange phenomena in soil and its role in plant nutrient availability; movement of nutrients from soil to plant roots, their uptake and translocation.</p> <p>The students will be able to explain chemistry of soil nitrogen- Nitrogen cycle, mineralization and immobilization, properties and use of inorganic and organic nitrogenous fertilizers in crop production. Chemistry of phosphorus in soil, phosphate fixation and availability chemistry of potassium in soil, potassium fixation and availability; properties and use of phosphorus and potassium fertilizers, chemistry of calcium, magnesium and sulphur in soil, their sources and usage; soil fertility evaluation and fertilizer recommendations; biofertilizers; integrated nutrient management ; methods and time of application of fertilizers, efficient of fertilizers.</p>
20	Agri. Marketing and International Trade	2+1	<p>Students will be able to understand he concepts of marketing, human needs and marketing the marketing mix, the marketing strategy, product planning, promotion Physical distribution and pricing, marketing and different levels of development, function of prices and role of price in economic development, marketing planning and organizational elements of marketing mix, Concept of market segment, market segmentation, basis of market segmentation, Types of markets, classification and characteristics of agricultural market.</p> <p>Students will be able to explain demand for farm products; determinants of consumer behaviour, consumers of farm products factors affecting demand and consumption of farm products; supply of farm produces; product decision and strategies, product life cycle and new product development, characteristics of farm firm, farm products and farm production, spatial and temporal distribution of farm products, marketed and marketable surplus, factors affecting supply of marketed surplus and marketable surplus of farm products;</p> <p>Students will be able to describe women’s role in agricultural produce marketing; pricing and promotion</p>

			<p>strategies market structure, determination of price under alternates market structures, price movement overtime seasonal cyclical and trend marketing communication, advertising, publicity, personnel selling and sales promotion; Marketing function, exchange function's buying and selling physical function storage, transportation and processing; facilitating functions- packaging, branding, financing, market information, grading etc.</p> <p>Management of marketing functions, marketing channels; stages of marketing, selection and management of marketing channels for farm products; meaning and components of marketing cost, price spread and market margins, Marketing efficiency, concept and measurements of marketing efficiency;</p> <p>Students will be able to understand the role of government in Agricultural marketing, public sector institutions. CACP, FCL, CWC, DMI, Fair price shops, Exim Bants etc. The concept and importance of inter-regional and International trade; emerging scenario of international trade in Agricultural commodities; basic theories of international trade; concept of terms of trade and BOP, implications of new GATT agreement (WTO).</p>
21	Field Crops I (Kharif)	2+1	<p>Students will be able to get exposure of origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices yield of kharif crops.</p> <p>Students will be able to take information for cereals-rice, maize, sorghum pearl millet and finger millet; pulses – pigeon pea, mungbean and urbeans oilseeds groundnut, sesame and soybean; fibre crops cotton, jute and sunhemp; and forage crops sorghum, maize, cowpea, cluster bean and napier.</p>
22	Crop Diseases and their Management	2+1	<p>Students will be able to understand and explain wheat disease rusts, loose nut, kernalbunt, powdery mildew, alternaria blight, yellow ear rot, ear cocile, Rice disease blast, brown spot, bacterial blight, sheath blight khaira and tungro; Maize disease stalk rots, downy mildews, leaf spots and Heininthosporium leaf sports; Sorghum disease smuts. Grain mold, anthracites and strgaa; Bajra disease downy mildews and ergot; Sugarcane disease redrot, smut, and with Groundnut disease early and late leaf sports, Sclerotium stem rot, seedling rot and seedling blight; Sunflower disease Sclerotinia stem rot and Alternaria blight; mustard disease. Alterniaria blight, white rust, downy mildew, Sclerotinia stem rot, and bacterial rot; soybean disease Rhizoctonia blight, pod blight, seed rot, bacterial pustule seedling blight and mosaic; pigeonpea diseases Phytophthora blight, wilt and sterility mosaic; Gram diseases Wilt, grey mould and Ascochyta blight; Lentil disease rust and wilt; Cotton disease anthracnose; vascular wilt, and black gram; Tobacco diseases damping off early and late blight, black scarf, common scab, bacterial wilt and virus diseases; Tomato diseases damping off, late and early blight, wilts root knot and virus diseases; Brinjal diseases Phomopsis blight, fruit rot, Sclerotinia rot, bacteria wilt and rot knot, Chilies diseases anthracnose and virus diseases, vegetable crucifer diseases damping off, Downey mildew, and black not, vegetable cucurbit diseases powdery mildew and rust, Bean diseases anthracnose, blights, and virus diseases; Mango diseases Mango malformation. Powdery mildew and bacterial blight; Apple diseases scab, collar rot, powdery mildew; fire blight, stem black and brown, pink diseases, Papaya diseases stem and foot rot, leaf curl, and mosaic, Citrus diseases canker, anthracnose, citrus decline and virus disease; Peach and pear disease leaf curl, brown rot, and scab; Guava wilt, anthracrose and stem canker.</p>
4th Semester			
23	Economic Entomology	2+1	<p>Students will be able to explain how insects become pest economic importance of insects, classification of pests, principles and methods of pest control, viz, physical mechanical, cultural, legal, genetical chemical. Biological,</p>

			<p>principles and methods of insecticidal applications.</p> <p>Students will be able to understand the concepts of apiculture, sericulture and lac cultivation with special reference to equipment used insect pests and diseases, production and marketing.</p>
24	Introduction to Plant Biotechnology	1+1	<p>The students will get exposure to the introduction: History of Plant tissue culture and biotechnology, scope and importance of agricultural biotechnology, Gene technology, Tissue and cell culture: Media, various modes of culture and their application. Organ culture cell suspension culture, Callus culture, Micro-propagation methods.</p> <p>Students will be able to explain organogenesis and embryogenesis, their significance, Anther culture; haploid production, diploidization and their significance, Proto plasts isolation, fusion, somatic hybridization and hybrids, Somaclonal variation and its use in crop improvement, Germplasm storage and cryopreservation, Secondary metabolite production, Students will be able to understand introduction to genetic engineering and genetechonology. Gene transfer methods: Physical Chemical and Agrobacterium dependent methods, Generation of transgenic plants and their identification, Molecular markets, RGLP, RAPD, Simple sequence repeats etc, Role of biotechnology in crop improvement.</p>
25	Field Crops II (Rabi)	2+1	<p>Students will be able to get exposure of origin geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops.</p> <p>Students will be able to take information for cereals wheat, barley and triticale; pulses chickpea, lentil, peas, frenchbean; Oil seeds, rapeseed and mustard, sunflower, safflower and linseed; sugar crops sugarcane and sugarbeet, Regional medicinal and aromatic crops such as mentha, lemon grass, citronella, palma rosa, Isabgol and posts, potato and tobacco, Forage crops berseem, Luceme and Oat.</p>
26	Agriculture Co-operation, Finance and Busi. Mgt.	2+1	<p>Students will be able to understand the concepts of cooperation- Meaning, significance under Indian agricultural conditions, objectives principles of cooperatives.</p> <p>Students will be able to explain agricultural cooperation in India credit marketing consumer and multi- purpose cooperatives, farming cooperatives, processing cooperatives, cooperative warehousing, role of ICA, NCU, NCDC, NAFED etc.</p> <p>Students will be able to explain about women cooperatives, Agriculture finance meaning, scope and significance, credit needs of Indian agriculture, economic principles in capital acquisition and use decisions, preparation and analysis of financial statements, balance sheet and income statement, cost of credit, Access for women to agricultural credit facilities. Agricultural credit market- institutional and non-institutional sources of credit, cooperatives credit system.</p> <p>Students will be able to describe commercial banks and regional rural banks, NABARD and AFC, problems and issues in institutional agricultural credit system. Business management environment of agricultural business, tasks of a professional manager, management system and processes, types of management decisions, decisions, decision making techniques and processes, organizational culture and management ethics.</p>
27	Insect Pest and their Management	2+1	<p>Students will be able to explain nature and extent of damage, life cycle seasonal history, host range, distribution and management of the major insect pests attacking field drops; Cereals, pulses, oilseeds, fiber, sugar crops,</p>

			<p>Horticultural crops; brinjal, okra, potato, tomato, cole crops, leguminous vegetables, cucurbits, chillies sweet potato, leafy vegetables, onion and garlic, colocasia, yarn. Fruit crops (tropical/sub tropical); jack fruit, papaya, coconut and date palm, mango, citrus, litchi, banana, guava, peach, poar, plum, apricot, chestnut, almond. Plantation and garden crops: marcptics, spices and condiments.</p> <p>Students will be able to get information of stored grain and household pests; Locust and other major polyphagous insects, Rodents and mites of agricultural importance.</p>
28	Fruit and Plantation Crops	2+1	<p>Students will be able to understand the importance and scope of fruit and plantation crop industries in India Cultivation practices of important fruit and plantation crops with reference to their origin, soil and climatic requirements; botany, important cultivars, plant propagation practices, resources and planting.</p> <p>Students will be able to learn care and management in respect of irrigation, nutrition and other cultural operations including training and pruning, nutrient deficiencies of fruit plant and their collection, inter cropping, major cultivation problem and their control measures, harvesting, yield, storage and marketing; application of plant bioregulators; post-harvest and technology of plantation crops.</p> <p>Students will be able to describe management of major insect- pests and disease, principles and methods of evaluation of fruit trees, project formulation and evaluation, commercial orchard.</p>
29	Livestock Production	2+1	<p>Students will be able to get exposure to the place of livestock in the national economy, efficient livestock development programme of government of India.</p> <p>Students will be able to get information about importance of exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factors affecting livestock fertility, reproductive behavior like estrus, parturition, farrowing, milk secretion, milking of animal and factors affection milk yield and composition of milk.</p> <p>Students will learn selection and breeding of livestock for higher milk and meat production. Feeding and management of calves, growing of heifers and milch animal and other classes and types of animals. Housing principles, space requirement for different species of livestock. Disease control and measures of measure livestock diseases, sanitation and care. Breeding feeding and production records.</p>
30	Rainfed Agriculture	1+1	<p>The students will get exposure to history of rainfed agriculture, magnitude of its problem and delineating criteria for rainfed and drylands, soil and climatic conditions prevalent in rainfed area.</p> <p>The students will be able to explain water stress in relation to crop productivity, concept of crop productivity and plant type for rainfed farming areas and crop improvement for efficient water use, drought resistance in crop plants.</p> <p>Students will be able to understand the concepts of efficient utilization of water through soil and crop management practices; reducing water losses through mulching and use of anti-transpirants, their kinds, mode of action and effect on crop yield. Increasing water storage by reducing run off and increasing infiltration through mechanical and cultural measures, water harvesting techniques, watershed management. Efficient management of rainfed crops; land preparation, seeding and crop density, selection of efficient crops and their varieties, alternate</p>

			cropping and land use strategies, soil fertility management and fertilizer use techniques, weed control and interculture operation, mid season correction for mitigating the aberrant weather, agro techniques for hilly tracts.
5th Semester			
31	Poultry Management	2+1	<p>Students will be able to get exposure to important Breed characteristics of poultry, their methods of rearing, breeding, feeding and management. Incubation hatching and breeding, vaccination and prevention of diseases.</p> <p>Students will be able to explain about preservation and marketing of eggs, its economics and keeping quality. Broiler production and rearing, hatchery management.</p>
32	Mushroom Cultivation	1+1	<p>Students will be able to get exposure first record of cultivated edible fungi, definition of mushrooms, present scenario of mushroom cultivation uses nutritional and medicinal values of mushrooms, general morphological features and important characters for identification of different edible mushrooms and biological backgrounds for mushroom breeding.</p> <p>Students will be able to explain definition of spawn and their types, methods of spawn production raising cultures, preparation of spawn media/master culture/commercial grade spawn, characteristics of good spawn, storage of spawn. Cultivation of <i>Agricus</i> species: Students will be able to understand the concept of compost and its formulations, preparation of compost using short and long methods of composting, turning schedules, compost microflora and different temperatures zones. Spawning and methods of spawning. Preparation of casing mixture and its sterilization, identification, isolation and management of different diseases, pests and competitors/moulds. Methods of harvesting mushrooms, after care of harvested fruit bodies, after care of beds and crop rooms on ruminant of crop. Cultivation of <i>Pleurotus</i>, <i>Volvariella</i>, <i>Lentinus</i> and <i>Auricularia</i> sp: Types of substrate, substrate preparation and its sterilization; spawn and methods of spawning, spawn run and cropping, harvesting and packing, processing of mushrooms: Different methods- canning, dehydration, freeze drying and bringing etc.</p>
33	Elementary Crop Physiology	2+1	<p>Students will be able to get exposure to introduction to plant physiology, plant cell an introduction, laws of thermodynamics, diffusion and osmosis.</p> <p>Students will be able to understand concept of water potential, cell water relations, absorption of water, transpiration, stomatal physiology, ascent of sap, ion uptake and metabolic utilization of mineral ions, deficiencies of mineral ions in plants, photosynthesis, respiration, fat metabolism, physiology of growth and development, growth regulators, physiological parameters influencing the productivity of major cereal, pulse and oilseed crops.</p>
34	Farm Machinery and Power	2+1	<p>Students will be able to understand the concepts of sources of farm power including non-conventional sources, farm mechanization, tillage, primary and secondary tillage equipment, specialized tillage tools, seeding and fertilizer machinery, specialized sowing and planting machine, inter culture equipment, plant protection equipment, harvesting and threshing machinery, chaff cutter.</p> <p>Students will be able to get information for estimation of operating cost of farm equipment. Basic engine types, parts of I.C. engine, working of different engine systems, types of tractors, working of different tractor systems</p>
35	Farm Mgt. and Natural	2+1	Students will be able to understand meaning, concept, objectives, nature and scope of farm management.

	Resource Economics		<p>Meaning and definition of farm, structure and characteristics of farm business. Students can explain different types of farms and factors determining types and size of farm.</p> <p>Students will be able to explain basic principles of farm management factor – factor and product-product relationships, law of equilmarginal returns and law of comparative advantage. Students will understand meaning and concept of cost, types of cost and their importance in farm management decision making. Concepts of farm returns.</p> <p>Students will be able to analyse farm business and various measures of efficiency.</p> <p>Students will understand importance of farm business records and accounts, inventory balance sheet. Profit and loss accounts of farm.</p> <p>Students will be able to explain status of farm inputs land, labour, capital. Farm planning and budgeting meaning and importance of farm plan and farm budget, partial and complete budgeting, formulation of farm plan and budget. Concept, subject matter and importance of natural resources economics.</p> <p>Students will be able to Classify natural resources and explain the basic terms ecosystem, biomass, biosphere, reserves, rate of use, environment, pollution etc. and concepts of natural resources of economics-ecology.</p> <p>Students will understand natural resources management and conservation, issues in natural resource use of management the benefit cost approach to natural resource problems.</p> <p>Students will be able to explain time element in decision making and benefit cost analysis. The basic theory of natural resource economics efficiency in private market economy, externalities in natural resource use and alternative solution thereof,</p> <p>The students will understand important issues in economics and management of land, water and forest resources and the environment. Natural resources administration and policy formulation.</p>
36	Fundamentals of Extension Education and Rural Development	2+1	<p>Students will be able to understand meaning, concept and process of extension education, objectives, principles and philosophy of extension.</p> <p>Students will be able to explain history of extension work. Education-formal and non-formal. Components of behaviour-knowledge, attitude, skills and motivation.</p> <p>Students will understand Principles and steps in teaching learning process, learning situation, Implications of teaching. Concept need and steps in programme planning. Students will be able to use principles of programme planning, programme planning process.</p> <p>Students will understand concepts of Panchayati Raj Institute, reorganization and its role in programme planning.</p>

			<p>Extension evaluation its meaning, principles, steps, techniques and criteria. Students will be able to analyse Critically various extension programme.</p> <p>Students will understand meaning and importance of rural leadership, Types, selection and qualities, training of leadership.</p> <p>Students will be able to explain meaning of administration, public administration and extension administration. Coordination and team work. Organization POSDCORB, organization and management of NES and reorganized extension system. Rural development programme: an over view of CD programme before 1952, agricultural/rural development programme ADP, LAAP, CADP, HYVP, SFDA, hill area development programme, integrated tribal development project.</p> <p>Students will be able to prepare integrated dryland farming project.</p> <p>Students will be able to understand integrated child development scheme, IRDP, TRYSEM, JRY, DWCRA, <i>mahila uthan yojana</i>, <i>Sunishchit rojgar yojana</i>. Role of voluntary organizations in rural development, women in agriculture and rural development.</p>
37	Post-Harvest Mgt. & Processing of Fruits and Vegetables	2+1	<p>To study the importance of Post-harvest management for fruits and vegetable</p> <p>To learn total production and consumption pattern</p> <p>To understand the Post harvest losses in fruits and vegetables</p> <p>To learn about Maturity and ripening process</p> <p>To understand the biochemical changes after harvesting</p> <p>To learn the quality management for fresh marketing and processing</p> <p>To study Storage of fruits and vegetables – ambient, low temperature and controlled atmosphere storage system</p> <p>To learn about Packaging of fresh and processed products</p> <p>To learn about Transportation system, mode of marketing, sorting, grading and handling</p> <p>To study the Pretreatment of fresh produce for marketing and processing</p> <p>To study the general principles and methods of preservation and preparation of jam, marmalade, tomato products, pickles and chutney, drying fruits and vegetables, fruit beverages, juices, squashes, nectars, cordials, by products of fruits and vegetables processing industries such as vinegar, cider</p> <p>To study about Canned fruits and vegetable products, frozen fruits and vegetables</p> <p>To study about government policies, regulation and specifications for fresh and processed products</p> <p>To learn about the export promotion agencies and their role in export of fresh and processed products.</p>
38	Practical Crops Production – I	0+2	<p>Students will be able to understand the complete Practical acquaintance relating to scientific production techniques of major field crops of the season (kharif) including sowing weeding hoeing fertilizer and manure application, harvesting etc.</p>
6th Semester			
39	Farming System and Sustainable Agriculture	2+1	<p>Students will be able to recycle of agricultural and industrial organic wastes; wastelands and their management; reclamation and management of acidic, saline and sodic soils, soil erosion; extent, type and effects; soil</p>

			<p>conservation techniques, watershed mgt.; application of remote sensing for assessment of soil and water resources.</p> <p>Students will be able to utilise mulching, wind breaks, water harvesting, tied ridging, strip cropping. Permeable contour line barriers and water ponds.</p>
40	Conservation and Management of soil and water resources	1+1	<p>Students will be able to understand different soil resources of India; distribution of waste land problem soils; water resources of India and their utilization in crop production; soil tilth management and relationship with tillage; tilth requirement of different crops; soil impedance layers and their improvement; management of soil water energy state of water in soil and availability to plants; management of soil moisture under different climates; water harvesting techniques, effect of water quality on soil and plants; soil aeration problems and management; soil thermal regimes in relation to crops and their optimization.</p> <p>Students will be able to recycling of agricultural and industrial organic wastes; wastelands and their management; reclamation and management of acidic, saline and sodic soils, soil erosion; extent, type and effects; soil conservation techniques, watershed mgt.; application of remote sensing for assessment of soil and water resources.</p>
41	Ornamental Horticulture	2+1	<p>Students will be able to explain importance of ornamental gardening in human life, theory and practice of landscape and formal garden for various places, identification, use of ornamental plants for the beautification of private and public places, styles of gardens, formal, informal etc.</p> <p>Students will be able to understand different concepts of landscape and town planning, ornamental plants for rural and urban areas, indoor gardening, post culture; bonsai, hanging baskets etc.</p> <p>Students will be able to understand principles and practices involved in growing ornamental annual and perennial plants, planning and layout of various parts of garden, herbaceous and shrubbery borders, lilly pots, rock gardens etc. cultivation of important ornamental plants, rose, gladiolus, chrysanthemum, tuberose, orchids, athurium, gerbera, dahlia, fern, palms, cycades, cacti etc. Post-harvest technology, project formulation and evaluation.</p>
42	Environmental Science	2+1	<p>Students will be able to understand Introduction to Environmental Sciences for following heads:</p> <ul style="list-style-type: none"> ▪ Definition, scope and importance (the multidisciplinary nature of environmental sciences) ▪ Need for public awareness on Environment, Role of individual in Environmental protection <p>Students will be able to explain Natural Resources (Renewable and Non-renewable Resources):</p> <ul style="list-style-type: none"> ▪ Natural Resource conservation: concepts ▪ Freshwater resources: use and over-exploitation of surface and ground water, conflict over water, hydroelectric projects, problems, traditional methods of harvesting of freshwater resources. ▪ Mineral resources: use and exploitation, environmental effects of extracting mineral resources, Lime stone quarrying in Uttaranchal ▪ Food resources: World food problems, changes caused by agriculture and overgrazing, effect of modern agriculture, fertilizer operated problem, water logging, salinity. ▪ Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. ▪ Land resources: Land as a resources, land degradation, landslides, soil crosion and desertification.

		<p>Ecosystems:</p> <ul style="list-style-type: none"> ▪ Concept, structure, and components of an ecosystem. ▪ Abiotic and biotic variables. ▪ Ecosystem function, trophic levels, energy flow, food chain, food web, Ecosystem, homeostasis. ▪ Examples of ecosystems (aquatic: pond, lake, river) ▪ Terrestrial ecosystem: Forest, mountain ▪ Ecological succession. <p>Biodiversity and its conservation:</p> <ul style="list-style-type: none"> ▪ Introduction:- Definition, genetic, species and ecosystem diversity. ▪ Bio-geographical classification of India ▪ Values of biodiversity: 5 Es (Esthetic (Aesthetic), Economic, Environment, Ethical, Emotional). ▪ Biodiversity at global, national and local levels. ▪ India as a mega diversity nation, hot spots of biodiversity. ▪ Himalayan wildlife: Habitat loss/poaching of wildlife, man-wildlife conflicts, and conservation. ▪ Threatened categories as per IUCN. ▪ Conservation of biodiversity: <i>In-situ</i> and <i>Ex-situ</i> conservation of biodiversity. <p>Students will be able to understand the concepts of Applied environmental science Environmental Pollution</p> <ul style="list-style-type: none"> ▪ Definition, causes, effects and measures of Air pollution. ▪ Water pollution and thermal pollution. ▪ Marine pollution. ▪ Noise and radioactive pollution. ▪ Solid waste and their management (municipal, industrial (hazardous and non-hazardous), problems of solid waste disposal in Uttaranchal and integrated Solid Waste Management (ISWM). ▪ Environmental hazards in Himalayas (floods, river, blockades, cloud burst, landslides, earthquakes). <p>Students will be able to explain Environmental problems and Environmental Protection</p> <ul style="list-style-type: none"> ▪ <i>Anthropogenic</i> and natural environmental problems. ▪ Environmental ethics; issues and possible solutions. ▪ Climate change, global warming: causes, effects and mitigation (national and international efforts) ▪ Ozone layer depletion: causes, effects and mitigation. (national and international) ▪ Environmental Protection Act 1986 ▪ Air (Prevention and Control of pollution) Act, Water (Prevention and control of Pollution) Act. ▪ Wildlife Protection Act 1972 ▪ Forest Conservation Act 1980 ▪ The Biological Diversity Act 2002 ▪ Issues involved in enforcement of environmental legislation, public awareness, Article 48A and 51A ▪ Automobile Emission standards (Eco/Bharat), Ecomark <p>Human Population and the Environment:</p> <ul style="list-style-type: none"> ▪ Population growth, variation among nations, population explosion Family Welfare Programme. ▪ Environment and human health.
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43	Silviculture and Agro Forestry	2+1	<p>Students will be able to understand Introduction basic terms, concepts and scope, national and global need, growth and development of trees and forest stands growth and developmental stages and growth measurements, factors affecting tree and stand growth, plant succession kinds and causes, natural and artificial regeneration establishment and care of tree nurseries tending operations cleaning, weeding, thinning, pruning.</p> <p>Students will be able to explain cultural operation classification, regeneration and crop characteristics of major Silvicultural systems, basic concepts of rotation, sustainable yield management and multiple use, establishment of forest stands/crops and agroforestry-selection and management of tree and crop species i.e. planting density, geometry and Silviculture, comparison among various land uses-mixed farming, multiple cropping and agroforestry, Interactions between components of agroforests for various resources and productivity. Problems, choice and management of agro-forestry systems in various agro-climatic zones.</p>
44	Seed Production and Processing Technology	2+1	<p>Students will be able to understand the concepts of Seed, its importance in green revolution difference between grain and seed, concept of seed quality, steps involved in seed production. Seed technology, its objectives and its role in increasing agriculture production. Seed industry in India.</p> <p>Students will be able to explain development of seed programmes, general principles of seed production. Seed replacement rate, multiplication rate, Breeder's, foundation and certified seed, maintenance of genetic purity, Nucleus and breeders seed production of newly released and established varieties of self-pollinated crops, viz, Rice, Wheat Soybean/chickpea, Pigeonpea, Rapeseed and Mustard etc.</p> <p>Students will be able to know maintenance of nucleus and breeder's seed in cross pollinated crop varieties, inbreds and non-inbreds, maintenance of seed of established varieties. Foundation and certified seed production of maize inbreds, single and double cross hybrids. Hybrid seed production of Sunflower, Sorghum, pearl millet and Rice using male sterility systems. Latest released hybrids of Maize, Sorghum, Bajra and Rice their characteristic feature, seed production of Wheat, Rice, Oats, Soybean, Gram, Urd, Moong, Sunflower, Pigeonpea etc. seed certification, its concepts, roles and goals, seed certification agencies, certified and truthfully labeled seeds.</p> <p>Students will be able to explain seed processing, storage and marketing, Minimum seed certification standards for self and cross-pollinated crops. Field and seed inspections objectives, general principles and methods, Seed sampling and seed testing for analytical purity, varietal identification through electrophoreses, Grow out test for cultivar purity, seed legislation and seed law enforcement including IPR, PBR in India, Record developments in seed.</p>
45	Practical Crops	0+2	Students will be able to understand the complete Practical acquaintance relating to scientific production technique

	Production – II		of major field of the season crop(s) including sowing weeding, hoeing, fertilizer and manure application, harvesting etc.
7th Semester			
46	General Economics	2+0	<p>The students will be able to understand Nature and scope and subject matter of economics and also approaches to economic analysis and nature of economic theory.</p> <p>The students will be able to state the basic terms and concepts of economics</p> <p>The students will be able to state the various theories related to consumer behavior such as equi-marginal utility, indifference curve, diminishing marginal utility.</p> <p>The students will be able to define law of demand and understand the concept of price, income and cross elasticities.</p> <p>The students will be able to explain factors of production i.e. land, labour, capital and enterprise and also understand and input-output relationships.</p> <p>The students will be able to describe law of variable proportions and laws of scale.</p> <p>The students will be able to understand the concepts of cost.</p> <p>The students will be able to describe Law of diminishing marginal returns.</p> <p>The students will be able to explain the Law of supply.</p> <p>The students will be able to explain the theories of rent, wage, interest and profit.</p> <p>The students will be able to understand the concepts of various types of markets and also Price determination and forecasting under them.</p> <p>The students will be able to understand the concepts of National Income and also approaches of measuring national income.</p> <p>The students will be able to explain theories of population.</p> <p>The students will be able to describe the concept and types of inflation.</p> <p>The students will be able to understand barter system of exchange and its problems.</p> <p>The students will be able to understand the concept of money and explain quantity theory of money.</p> <p>The students will be able to tell the various types of banks and their function.</p> <p>The students will be able to explain the basic feature of various economic systems,</p> <p>The students will understand the concept of international trade.</p> <p>The students will be able to specify special characteristics of agriculture and its role in economic development.</p> <p>The students will be able to explain the role of women in Indian Agriculture.</p>
47	Breeding and Improvement of Farm Animals	1+1	<p>Students will be able to understand reproductive systems of farm animals. Qualitative and quantitative inheritance and effect of environment on them. Various qualitative and quantitative traits of livestock. Weinberg law, variation, its measures, genetic, phenotypic and environmental variances.</p> <p>Students will be able to explain heritability and repeatability, its measurement and uses. Selection its genetic effect, selection for dominant and recessive gene and quantitative traits, selection differential, response to selection, generation interval and annual rate of gain.</p> <p>Students will be able to explain Genetic correlation and correlated response. Basic of selection, individual, family, progeny, pedigree and combined selection. Methods of selection for one or more traits random,</p>

			independent culling level and selection index. Inbreeding its consequences, inbred lines, line breeding, inbreeding, coefficient and relationship coefficient, out breeding – various types of our crossing and cross-breeding, species hybridization and development of new breeds.
48	Principles of Animal Nutrition	2+1	<p>Students will be able to understand Introduction to expanding field of nutrition, chemical composition of animal and its food, digestive systems and processes of farm animals. Digestion, absorption and metabolism of carbohydrates, lipids and proteins in protein content in various classes of feeds. Concept of essential amino acids for non-ruminants and protein quality of feeds.</p> <p>Students will be able to explain the absorption and metabolism of essential minerals and vitamins; symptoms of their deficiencies; minerals and vitamin content of various classes of feeds. The nutritive evaluation of feeds for energy and protein, digestibility of feeds values of feeds, nutrient requirements of farm animals for maintenance, growth reproduction and lactation. Growth stimulating substances.</p>
49	Element of Food Technology	2+1	<p>Students will be able to understand the scope and importance of food technology in Indian economy. Handling, transportation and storage of food grains, fresh milk, meat, fish and eggs; physical, chemical and nutritional characteristics of food grains – fresh meat, fish, milk and eggs; role of milling and size reduction in food processing;</p> <p>Students will be able to explain use of low temperatures in processing and storage of food grains, fresh milk, meat, fish and eggs; Drying and dehydration of food grains and concentration and evaporation of milk; Food fermentations and their application in food processing.</p> <p>Students will be able to know the role of food additives in the processing of food grains, milk, meat, fish, eggs and their products; Food irradiation and its application in extending shelf life of food grains, meat, fish, eggs and their products; Food packaging and its functions; By product's utilization and disposal of food industry wastes; quality control, total quality assurance (TQA) and various systems of TQA.</p>
50	Human Food and Nutrition	2+1	<p>Students will be able to understand different trends in food production and consumption in India. Role of agricultural scientists and food technologist in meeting national nutritional requirements. Definition of human nutrition, nutrient, nutritional care, health, nutritional status and good nutrition.</p> <p>Students will be able to explain food and its functions and functional classification. Calorific value of foods and its measurement. Digestion and absorption of various nutrients present in foods. Energy and nutrient needs of human body. Recommended dietary allowances for various age groups and classes of individuals.</p> <p>Students will be able to know common nutritional problems in India and their causes. Specific nutritional deficiencies and disorders including protein calorie malnutrition, nutritional anaemias, vitamin deficiencies, obesity, atherosclerosis. Clinical symptoms and diagnosis of deficiency disorders. Important food groups and their role in the management of deficiency disorders and diseases. Food habits and their effect on regional balance. Balanced diet and its formulation.</p> <p>Students will be able to understand the food born infections and food hygiene. Effect of processing on the nutritional value of foods. Applied nutritional programme in country, nutritional policies of government. Food fortification, enrichment and restoration, supplementary feeding programmes for vulnerable groups. State,</p>

			national and international agencies dealing with nutritional programmes.
51	Soil Taxonomy, Survey and remote sensing	2+1	<p>Students will be able to explain types of soil survey, morphological, physical and chemical properties used in distinguishing and classifying soils.</p> <p>Students will be able to understand principles of soil taxonomy, classification system. Soils of India and their classification. Advantages of taxonomic classification of soils. Remote sensing introduction, definition, concept, principles, importance, scope, types, merits and demerits and its application in agriculture and soil classification.</p>
52	Production Technology of Medicinal and Aromatic Plants	0+2	<p>Students will be able to know importance and scope of medicinal and aromatic plants, geographical distribution of species, botanical description, management of nurseries, climate and relation to medicinal and aromatic plants, improved varieties, soil and land preparation, intercultural practices, irrigation and insect-pest management, post-harvest techniques, harvesting processing, storage and herbage/constituent yield.</p> <p>Students will be able to know the following medicinal and aromatic plants. <i>Medicinal Plants:</i> Sarpagandha, poppy, sadabahar, digitailis, dioscora, solanum, brahmi, isabgol, senna, aloe, neem, cinchona and Ipecac. <i>Aromatic Plants:</i> Essential oils: Mints-menthol mint, pepper mint, Spearmint, bergamot mint; Aromatic grasses lemon grass, palmarosa, citronella, vetiver; Ocimum, geranium, pachauli, dill (Sowa), Cinamon, pine, eucalyptus, sandalwood, liquorice <i>Flower perfume:</i> lavender, rose, rosemary, jasmine</p>
8th Semester			
53	Rural Agriculture Work Experience	0+20	<p>Students will be able to learn and understand different below mentioned topics each student will have a choice to opt any of the four components given below. He/she will submit his/her work in form of a report and present the results in the seminar.</p> <ol style="list-style-type: none"> i. Agro-based Industries – Seed processing plants and industries, fruit preservation industries, food processing industries etc. ii. Plant clinics iii. NGO iv. Socio economic studies v. Apiculture vi. Sericulture vii. Mushroom Cultivation viii. Attachment with agriculture Departments ix. Attachment with Agriculture research institutes/organizations/agencies.

B.Sc. Biotechnology

Programme Code: 140

Course Summary

Duration: 3 years

Eligibility

10+2 with minimum 45% marks in aggregate with PCB

Program outcome:

B.Sc. Biotechnology with CBZ programme is a three-year degree. In the three years students will tackle core subjects to ensure that they receive a solid grounding in fundamentals. The programme comprises courses on Biotechnology, Zoology, Botany and Chemistry which provides the opportunity to students for gaining knowledge in multidisciplinary subjects and labs, namely

- To develop skills for general Biotechnology techniques.
- To understand fundamentals of Cell Biology, Biochemistry, rDNA technology, Molecular Biology, Genetics, Plant tissue culture, Bioinformatics and Intellectual property Right.
- To develop advanced knowledge and understanding relevant to Zoology and acquire knowledge of Demonstrated a broad understood of animal diversity, including knowledge of the scientific classification and evolutionary relationships of major groups of animals.
- The entire animal's functions of the body are studied in this part. It includes nutrition. Respiration, heart, excretion, nerve physiology etc in which all structure, function, process and control are to be studied.
- Understand the environmental and basic concept of taxonomy, ecology, Determine economic & medicinal plant in agriculture and medicine, Analysis the relationship between plants and microbes, understand the biology of diversity of seed plants or phanerogames, Understand the behaviors of fossils and gymnospermic plants, Understand the plant disease, chemical properties and evolutionary relationship among taxonomic groups.
- The Bachelor of Science in Chemistry programs offer students a more quantitative experience in chemistry. To provide in-depth knowledge of element, compound, scientific and technological aspects of Chemistry. To familiarize with current and recent developments in Chemistry.

Course outcomes:

S. No.	Course name	Credits	Course outcome
1st Semester			
1	Biotechnology (Biochemistry & Metabolism)	4	Introduction to Biochemistry. To study the structure and functions of different biomolecules. To learn about enzymes including classification, properties and coenzymes. To study carbohydrate metabolism and beta oxidation.
2	Zoology (Animal Diversity)	4	To introduce the kingdom protista, Phylum Porifera, Coelenterata, Platyhelminthes, Nematyhelminthes, Annelia, Arthropoda Mollusca, Echinodermata, and All classes of Chordata with referenceces general character and classification upto classes. To learn about the different phylum system-locomotion in Protozoa, Canal System in Sycon (Porifera), Polymorphismin Hydrozoa(Cnidaria), Life history of Taenia and Ascaris (Helminthes), Metamerism inAnnelida, Metamorphosis in Insects(Arthropoda), Torsion in gastropods(Mollusca), vascular system in Asteroidea(Echinodermata), Phylogeny of Protochordata, Osmoregulation in Pisces, Parental care in Amphibia, Poisonous and non-poisonous snakes, Biting mechanism in snakes Flight adaptations and Origin of mammals.
3	Botany (Biodiversity (Microbes , Algae, Fungi and archegoniate)-)	4	To Understand the discovery, general characters Economic Importance and replication of virus and bacteria. To know about the, morphology, structure and Economic Importance and life cycle pattern of Algae and Fungi. To know about the general characters, classification morphology, anatomy and Economic Importance and life cycle pattern of Bryophytes, Pteridophytes, and Gymnosperms. To understand about fossil plants. To learn about the ecology and significance of lower plants. To know about general account and significance of lichens and mycorrhiza.
4	Chemistry (atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons)	4	Purpose of this paper at graduate level understanding of major concepts, theoretical principles and experimental findings in chemistry regarding Atomic structure, Chemical Bonding and Molecular Structure, Fundamental of Organic Chemistry, Stereochemistry and Aliphatic Hydrocarbons.
5	Laboratory course (Biochemistry & Metabolism)	2	To impart practical knowledge and hands on training based on course Biochemistry & Metabolism
6	Laboratory course (Zoology: Animal Diversity)	2	To impart the practical knowledge to identify the specimens and slides of different Phylum from Protozoa to Chordata.
7	Laboratory course (Botany:	2	To study about virus and bacteria by using photographs, temporary and permanent

	Biodiversity -Microbes , Algae, Fungi and archegoniate)		slides . To study vegetative and reproductive structure of algae, fungi, bryophytes by temporary and permanent slides.(Mentioned in syllabus) To study morphology and anatomy of pteridophytes and gymnosperms by temporary and permanent slides. To know about lichens and mycorrhiza by using photograph.
8	Laboratory course (Chemistry: atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons)	2	Developed the ability to use modern instrumentation for chemical analysis and separation techniques regarding Volmetric Analysis and Organic Chemistry.
	English	2	Write focused, organized, well-developed, and text-based essays using effective paragraphs, which support a clear thesis statement, and demonstrate competence in standard English grammar and usage.
2nd Semester			
9	Biotechnology (General Biotechnology)	4	To learn fundamentals of genetic engineering, PCR and Cloning. To understand the working and principles of instruments used in biotechnology. To understand the fundamentals of Animal Tissue Culture. To understand the concept of transgenics. To learn the applications of biotechnology in different fields.
10	Zoology (Comparative Anatomy and Developmental Biology)	4	To get knowledge about the integumentary system and their derivatives, skeletal system, digestive system, respiratory system as gills, lungs, air sacs and swim bladder, circulatory system as to study evolution of heart in differnt vertebrates. To study the comparative account of brain, evolution of urinogenital system, types of receptors in vertebrates. To understand the embryonic developement by gaining the knowledge of gametogenesis, vitellogenesis in birds and fertilization. To study the early developement of frog and humans upto the gastrula formation and study the movement in germ layers and their fate. To get knowledge about the late embryonic developement in humans and study plantation, placenta formation and types of placenta in humans. To study the metamorphic events in frog life cycle and control of developement by studying gene activation, determination, induction, differentiation, morphogenesis, intercellular communication and cell death.
11	Botany (Plant Ecology and Taxonomy)	4	To Understand the environments and basic concept of taxonomy, ecology. Determine economic & medicinal plant in agriculture and medicine. Analysis of the relationship between biotic and abiotic components of ecosystem and their relationship.. Understand the soil biology. Understand the plant nomenclature and their classification given by different scientists. Understand the different families of angiospermic plants.
12	Chemistry (Chemical Energetics,	4	This paper provide desirable knowledge to the students regarding Chemical Energetics,

	Equilibria Science & Functional Group Organic)		Chemical Equilibrium, Ionic Equilibrium, Aromatic Hydrocarbons, Alcohol, Phenols, Ether and aldehydes and Ketones.
12	Ability Enhancement Compulsory Course : Environment Sciences	2	The Environmental Studies major prepares students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective.
13	Laboratory course (Biotechnology: Biochemistry & Metabolism)	2	To impart practical knowledge and hands on training based on course General Biotechnology
14	Laboratory course (Zoology: Plant Anatomy and Embryology)	2	To impart practical knowledge about the disarticulated skeleton of fowl and rabbit, Carapace and plastron of turtle /tortoise, mammalian skulls: One herbivorous and one carnivorous animal. To get practical knowledge of frog developmental stages by whole mounts and sections through permanent slides as cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages, study of the different types of placentae through permanent slides or photomicrographs. Study of placental development in humans by ultrasound scans and Examination of gametes as frog/rat - sperm and ova through permanent slides or photomicrographs.
15	Laboratory course (Botany: Plant Ecology and Taxonomy)	2	Study the different instruments used in ecology and taxonomy. Study the morphological adaptations of aquatic and xerophytic plants. Determination of minimal quadrat size and minimum quadrat number to study the plant community. Study the components of ecosystem. Study of concept of herbarium. Study the plant species belonging to various families.
16	Laboratory course (Chemistry: Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I)	2	Developed an ability to conduct experiments, analyze data, and interpret results to use various techniques like that determination of different physical parameters such as pH, surface tension, viscosity etc and various organic synthesis methods.
17	Biotechnology (General Microbiology)	4	To know the fundamentals, history and evolution of microbiology and study the microbial diversity, distribution and characterization of prokaryotic and eukaryotic cells. Know various Culture media and their applications and also understand various physical and chemical means of sterilization. Comprehend the various methods for identification of unknown microorganisms Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism and mode of reproduction

			To know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement. To get information of important microorganism.
18	Zoology (Physiology and Biochemistry)	4	Understand concepts of growth and reproduction of bacteria. Know parts of microscope, type and its principal. Get the theoretical concepts of related stain. Understand different methods of staining techniques. Understand nutritional requirements of bacterial.
19	Botany (Plant Anatomy and embryology)	4	Understand the scope & importance of Anatomy and embryology of angiosperms. To know about the meristematic and permanent tissue, anatomy of dicot and monocot root, stem and leaf. To know about the various tissue systems root apex meristem and shoot apex meristem, secondary xylem and leaf growth. Understand the normal and anomalous secondary growth in plants and their causes. Sap wood and heart wood. To know about the microspogenesis and megasporogenesis, organization of embryo sac, pollen pistil interaction, methods of pollination and fertilization, endosperm and embryogenesis and polyembryony, apomixis .
20	Chemistry (Solutions, Phase Equilibria, Conductance, Electrochemistry & Functional Group Organic Chemistry-II)	4	The main purpose of this paper is to developed theoretical knowledge in various fields like that solutions, Phase Equilibria, Conductance, Electrochemistry under physical chemistry and carboxylic acid and their derivatives, amines and diazonium salts, amino acids, peptides and proteins, carbohydrates under organic chemistry.
21	Skill enhancement (for Zoology: Pisciculture)	2	To gain knowledge about the scope of aquaculture. To learn the techniques of fish farm managements. To gain knowledge about the fish culture techniques (Induced breeding & integrated fish farming). To learn about the fish nutrition and methods of live fish transportation. To gain knowledge about the fish diseases, treatment and preventive measures.
22	Laboratory course (Biotechnology: General Microbiology)	2	To impart practical knowledge and hands on training based on course General Microbiology. Develop basic skill in aseptic techniques. Understand various accessories for microbiology practicals. Perform various staining techniques. Cultivate bacteria with different cultivation technique.
23	Laboratory course (Zoology: Physiology and Biochemistry)	2	To impart practical knowledge about preparation of hemin and hemochromogen crystals, to examine the permanent slides of mammalian pituitary, thyroid, parathyroid, pancreas, adrenal, spinal cord, duodenum, liver, lung, kidney, bone, cartilage. To identify the unknown carbohydrates (Starch, Sucrose, Lactose, Galactose, Glucose, Fructose) and proteins in given solution. To study the activity of salivary amylase under

			optimum conditions.
24	Laboratory course (Botany: Plant Anatomy and embryology)	2	To study the simple and complex tissue by permanent slides. To study the anatomy of monocot and dicot root, leaf and stem by temporary and permanent slides. To study the abnormal secondary growth in some special case in root, leaf and stem by temporary and permanent slides. To study the floral parts particularly anther and pistil. To study the pollen grain and seed germination and viability in lab. To study the organization of various embryo sac, endosperms, monocot and dicot embryo.
25	Laboratory course (Chemistry: Solutions, Phase Equilibria, Conductance, Electrochemistry & Functional Group Organic Chemistry-II)	2	Developed an ability to conduct experiments, analyze data, and interpret results to use various techniques like that construction of phase diagram, Determination of critical points, study of variation of mutual solubility temperatures, determination of cell constant, equivalent conductance, potentiometric titration and different organic qualitative analysis, separation techniques etc. Skill enhancement paper aware to the students regarding application and uses of pesticide in daily life and handle the different pesticide techniques. Pesticide like that organochlorine, organophosphate, carbonate and annelids etc.
4th Semester			
26	Biotechnology (Immunology)	4	To understand the fundamentals of immunity & the immune system. Regulation of immunoglobulin gene expression. Genetic basis of Ab Diversity. To understand the concept of Ag processing and presentation, autoimmunity and immunodeficiency. Introduction to immunodiagnostics. To understand active and passive immunization.
27	Zoology (Genetics and Evolutionary Biology)	4	The goal of this course is create a deep understanding about inheritance, Mendelism, Chromosome to cistron journey and deviation Mendel and also how evolution works, and general knowledge about the most important research questions in evolutionary biology. To understand basic principles of Mendelian inheritance. To study cell division & chromosome segregation. To explore the multifactorial inheritance. To acquire the chromosome structure, chromatin organization and variation. To learn the concepts of Linkage concept of sex determination and sex linked inheritance. To gain knowledge about the organellar inheritance. The subject introduces students to all aspects of evolutionary biology. the course is to provide students with a deeper

			insight into the evolutionary processes - both selective and random - which can explain the genetic composition of populations, form, behaviour and distribution of organisms, and to teach students the basic methods of analysing the evolutionary relationships between species.
28	Botany (Plant Physiology and Metabolism)	4	To know about the metabolic activity and life cycle of the plant from germination through growth and development. Know importance and scope of plant physiology. Understand the plants and plant cells in relation to water-osmosis, imbibition, guttation, diffusion and water potential and the movement of sap and absorption of water in plant body, transpiration-structure and function of stomata, plant nutrition and essentiality and mechanism of absorption. Understand the process of photosynthesis particular light and dark reaction, photorespiration, respiration particular emphasis on aerobic and anaerobic respiration. To learn about enzymes structures, properties and their mechanism, nitrogen metabolism, plant growth regulators, photoperiodism and vernalization.
29	Chemistry (Chemistry-DSC 2d: coordination chemistry, states of matter & chemical kinetics)	4	In this paper students are expected to understand the colours and magnetic behaviour of transition metal complexes. In this branch of chemistry students know how the matter exist and the progress of reaction.
	Skill enhancement Paper (Chemistry: Pharmaceutical Chemistry Botany: Plant Diversity & Human welfare)	2	Chemistry: Skill enhancement paper aware to the students regarding application and uses of pesticide in daily life and handle the different pesticide techniques. Pesticide like that organochlorine, organophosphate, carbamate and anelides etc. Botany: To know about the plant diversity and its scope To study the values of biodiversity. To study the threats to biodiversity and its management practices. To study the conservation studies of biodiversity. To study the role of different plants in relation to human welfare. i.e. cereals, pulses, fruits etc. To study the social forestry, its utilization and commercial aspects.
30	Laboratory course (Biotechnology: Immunology)	2	To impart practical knowledge and hands on training based on course Immunology.
31	Laboratory course (Zoology: Genetics and Evolutionary Biology)	2	To impart practical knowledge, Numerical problems and evolutionary theories based on Genetics and Evolutionary Biology.
32	Laboratory course (Botany: Plant Physiology and Metabolism)	2	1.To learn about measurement of water potential by osmosis and plasmolysis method. 2. To demonstrate the rate of transpiration by using potometer. 3.To learn demonstrate the importance of photo-synthesis by the help of wilmonnt

			<p>bubbler and inverted funnel exp.</p> <p>4. To study plant movement by the help of clinostat.</p> <p>5. To study separation of leaf pigments by paper strip chromatography.</p> <p>6. To study structure of stomata and role of stomata in transpiration by using four leaves exp.</p>
33	Laboratory course (Chemistry: Chemistry of s-and p-block Elements, States of Matter & Chemical)	2	All practicals are related to theory paper CHEMISTRY
5th Semester			
34	Biotechnology (Plant Biotechnology)		This course provides graduate-level knowledge of and expertise in plant tissue culture theory and practice. This course has a vocational focus and introduces the student to the theory and practice of plant tissue culture and their role from modifying plants in plant biotechnology to the propagation of endangered plants. Students study media, sterilisation, explants, micro propagation, callus culture, organogenesis, embryogenesis, somatic variation, doubled haploids, interspecific hybrids, protoplast fusion and environmental conditions required. These are related to uses of tissue culture and compared with traditional techniques.
35	Zoology (Reproductive Biology)	4	<p>To learn about the gonadal hormones, mechanism of hormone action and hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin.</p> <p>To understand about male and female reproductive system, development and differentiation of gonads, genital ducts, external genitalia and mechanism of sex differentiation</p> <p>To acquire knowledge about histology of male reproductive system, cellular functions, germ cell, system cell renewal, androgen synthesis and metabolism Epididymal function and sperm maturation, Accessory glands functions; Sperm transportation in male tract.</p> <p>To understand the histology of ovary, folliculogenesis, ovulation, corpus luteum formation and regression, hormones biosynthesis and secretion of ovarian hormones, fertilization, hormonal control of implantation; hormonal regulation of gestation , diagnosis of pregnancy, parturition, lactation and its regulation and reproductive cycles.</p> <p>To gain knowledge about infertility in male and female: causes, diagnosis and management</p> <p>To understand the modern contraceptive technologies.</p> <p>To acquire knowledge about the demographic terminology used in family planning.</p>
36	Botany (Cell and molecular Biology)	4	Demonstrate understanding of selected basic principles & concepts about biological techniques like light and electron microscopy. To understand intracellular

			compartmentalization. Their structure, organization and functions. To learn about the structure and functions of cell wall and cell membrane. To understand the concepts of Molecular Biology. Learn experimental evidences for nucleic acid as carrier of genetic information. To understand DNA replication, transcription, translation in Prokaryotes and Eukaryotes. To study the basic features of genetic code. To understand the regulation of gene expression in Prokaryotes and Eukaryotes.
37	Chemistry (ANALYTICAL METHODS IN CHEMISTRY)	4	Spectroscopy is basic tool for understanding analytical techniques. Students are expected to understand basic concept about spectroscopy. Chromatography is an important biophysical technique that enables the separation, identification, and purification of the components of a mixture for qualitative and quantitative analysis.
38	Skill enhancement Paper (Biotechnology: IPR Entrepreneurship, Bioethics and Bio-safety)	2	Assessment of the potential of an opportunity and to determine its viability practical, social and commercial implications. Understanding entrepreneurial behaviour & characteristics associated with successful entrepreneurs. Efficient utilization of resources including finances to exploit an identified opportunity management of intellectual property, legal structures, ethical issues and risks of a new venture Preparation of a feasibility report for an identified opportunity to assess its feasibility and sustainability.
39	Laboratory course (Biotechnology: Plant Biotechnology)	2	To impart practical knowledge and hands on training based on course. ractical applications of in vitro methods. Plant tissue culture lab organization. To maintain the aseptc condition. Preparations of MS stocks and media.
40	Laboratory course (Zoology: Reproductive Biology)	2	To learn about set up and maintenance of animal house, breeding techniques, care of normal and experimental animals. To gain knowledge about the examination of vaginal smear rats from live animals. To learn about the principles of surgery in endocrinology. Ovarectomy, hysterectomy, castration and vasectomy in rats. To learn about the histological sections of male female reproductive organ from photomicrographs/ permanent slides of rat/human. To understand the human vaginal exfoliate cytology. To learn the technique of sperm count and sperm motility in rat. To learn about the modern contraceptive devices.
41	Laboratory course (Botany: Cell and Molecular Biology)	2	To impart practical knowledge and hands on training based on course.
42	Laboratory course (Chemistry: analytical methods in chemistry)	2	All practical's are related to analytical methods including spectroscopic technique and chromatographic techniques

6 th Semester			
43	Biotechnology (Bioinformatics)	4	To know the history of Bioinformatics with notion of Homology discussed. Sequence Information Sources like EMBL, GENE BANK, Entrez, Unigene and Protein Information Sources like PDB, SWISSPROT, TREMBL understood. Sequence and Phylogeny analysis including detecting Open Reading Frames, Outline of sequence Assembly have been described. Mutation/Substitution Matrices for Pairwise Alignments, including BLAST discussed. Multiple Sequence Alignment with reference to Phylogenetic Analysis outlined. Searching Databases using SRS, Entrez detailed. Genome Annotation including Pattern and repeat finding with emphasis on Gene identification tools performed.
44	Botany (Genetics and plant breeding)	4	To study the different terminologies involved in genetics. To study different laws of inheritance and their modified ratios. To study the cytoplasmic inheritance by different examples. To study the sex determination and sex linked inheritance To study the mutations and its role in plant breeding. To study the different methods of crop improvement in plant breeding. To study the inbreeding depression and heterosis. To study the process of hybridization.
45	Zoology (Applied Zoology)	4	Introduce the Host parasite relationship. To be learn about epidemiology for diseases transmission, Transmission, Prevention and control of diseases: Tuberculosis, swine flu, typhoid, To develop awareness of <i>Rickettsia prowazekii</i> , <i>Borrelia recurrentis</i> and <i>Treponema pallidum</i> . To learn fundamentals of Parasitic Protozoa : Life history and pathogenicity of <i>Entamoeba histolytica</i> , <i>Plasmodium vivax</i> , <i>Trypanosoma gambiense</i> . And Parasitic Helminthes: Life history and pathogenicity of <i>Schistosoma haematobium</i> , <i>Ancylostoma duodenale</i> and <i>Wuchereria bancrofti</i> . To develop the knowledge of Insects of Economic Importance Biology, Control and damage caused by <i>Helicoverpa armigera</i> , <i>Pyrilla perpusilla</i> and <i>Papilio demoleus</i> , <i>Callosobruchus chinensis</i> , <i>Sitophilus oryzae</i> and <i>Tribolium castaneum</i> ; Safe storage of stored grains. To develop the knowledge of Insects of Medical Importance Life cycle, medical importance and control of <i>Pediculus humanus corporis</i> , <i>Anopheles</i> , <i>Culex</i> , <i>Aedes</i> , <i>Xenopsylla cheopis</i> , <i>Phlebotomus argentipes</i> . To teach the students about Animal Husbandry Preservation and artificial insemination

			<p>in cattle; Induction of early puberty and synchronization of estrus in cattle.</p> <p>To make the students aware about Poultry Farming Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs.</p> <p>Understand the Fish Technology Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed.</p>
46	Chemistry (Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy)	4	This branch of chemistry is very much related to living being that how any metal ion or group is important to human body and functions in our body. Students are expected to understand basic concept about spectroscopy.
47	Skill enhancement (Biotechnology: Bioprocess Technology)	2	<p>Describe the principle and applications of bioprocess technology.</p> <p>Understanding of upstream and downstream processing for product recovery and purification.</p> <p>Analyze the mass transfer and material balance calculation in different types of application in bioprocess.</p> <p>Analyze the kinetics parameter values in different types of fermentation modes.</p> <p>Discuss the important aspects in bioprocess technology for commercialization purpose of biotechnology products.</p>
48	Laboratory course (Biotechnology: Bioinformatics)	2	<p>To understand the sequence information resource.</p> <p>Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR).</p> <p>Understanding and using: PDB, Swissprot, TREMBL.</p> <p>Using various BLAST and interpretation of results.</p> <p>Retrieval of information from nucleotide databases.</p> <p>Sequence alignment using BLAST.</p> <p>Multiple sequence alignment using Clustal W.</p>
49	Laboratory course (Zoology: Applied Zoology)	2	<p>Give the knowledge of students to identify the permanent slides/photomicrographs and specimens of <i>Plasmodium vivax</i>, <i>Entamoeba histolytica</i>, <i>Trypanosoma gambiense</i>, <i>Schistosoma haematobium</i>, <i>Ancylostoma duodenale</i> and <i>Wuchereria bancrofti</i>.</p> <p>To impart the practical knowledge to identify arthropod vectors specimens associated with human diseases: <i>Pediculus</i>, <i>Culex</i>, <i>Anopheles</i>, <i>Aedes</i> and <i>Xenopsylla</i>.</p> <p>To develop aptitude of insect damage to different plant parts/stored grains through damaged products/photographs.</p> <p>To develop the skills for Identifying feature and economic importance of <i>Helicoverpa (Heliothis) armigera</i>, <i>Papilio demoleus</i>, <i>Pyrilla perpusilla</i>, <i>Callosobruchus chinensis</i>, <i>Sitophilus oryzae</i> and <i>Tribolium castaneum</i></p>

			To learn the practical basic fundamentals to visit a poultry farm or animal breeding centre and submission of visit report To impart the practical knowledge to maintenance of freshwater aquarium.
50	Laboratory Botany: Genetics and Plant Breeding	2	To study the mendel's laws and its modified ratios. To study the different types of aneuploidy syndromes. To study the chi square test To study the hybridization techniques. To study the Pedigree analysis To study the translocation ring, laggards and inversion bridge through photographs. Demonstration of polyploidy conditions in plants.
51	Laboratory Chemistry: Organomettals, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	2	In this lab course students are expected to understand the techniques so as they are able to analyses the organic compounds and synthesize their derivatives.

Bachelor of Commerce

Programme Code: 110

Programme Summary

Duration: 3 years

Eligibility

10+2 in any discipline with minimum 40% marks in aggregate.

Program outcomes:

- To demonstrate an advanced, specialized and well-rounded knowledge of the chosen academic discipline.
- To develop aptitude for formulating research problem and data collection and statistical planning.
- To acquire knowledge about Corporate accounting and Financial Accounting.
- To develop analytic thinking skills and sound oral and written communication skills so as to be able to communicate ideas effectively.
- Ability to compute taxable income of Individual.
- Ability to analyze financial data for managerial decision-making.
- Knowledge of business laws like contract Act, Sale of Goods Act ,Partnership Act , Negotiable Act.
- Knowledge of emerging field E-commerce and its working pattern.
- To be trained in recombinant in on-line filing return.
- Knowledge about GST and Cost Accounting procedure and technique.
- To gain knowledge of auditing and marketing.
- Understand the concepts of Indian economy & principle of micro economics.
- To integrate an advanced knowledge of ICT practices so as to make the best possible use of electronic sources for academic purposes.
- To develop creativity, sound judgment skills, autonomy, ethical maturity and academic integrity with regards to their chosen disciplines.
- To develop basic computer skills required for study and employment.
- Adapt to recent changes in Marketing, Human Resource, Taxation, Environment and in investment of securities

Course outcome:

S.	Course code	Course name	Credits	Course outcomes
1st Semester				
1	BC-101	Environmental Studies	2	<p>To understand appropriate sociological and technological measures in environment management.</p> <p>To focus on ecosystem services and human well being and livelihoods.</p> <p>To learn basis of problems and solutions in natural resource management</p> <p>To find solutions towards more sustainable societies around the globe.</p> <p>To learn strategies for waste reduction and disposal</p> <p>To contribute meaningfully for analysis of environmental systems planning and management with both a local and global perspective</p> <p>To understand the concept of sustainable development</p> <p>To be able to cope with the impacts of climate change by adopting adaptation and mitigation measures</p> <p>To prepare the students for national and global employability</p>
2	BC-102	Financial Accounting	6	<p>To provide knowledge on the fundamental of financial accounting.</p> <p>To expose the student to various financial transaction and its current application.</p> <p>Prepare ledger accounts using double entry book keeping and record journal entries accordingly</p> <p>To familiarize the concept of Branch account and its system</p> <p>To introduce the system of Hire Purchasing</p> <p>To provide knowledge on the fundamental of financial accounting.</p> <p>To familiarize the concept of Consignment and joint venture accounting</p> <p>To make the students to learn the various aspects of dissolutions methods</p> <p>Demonstrate the concepts of Tally ERP.9 Software, to create company, journal entries, and financial statement.</p>
3	BC-103	Business Organization and Management	6	<p>To enlighten with nature and scope of Business Organisation</p> <p>To familiarize the students about various sources of finance</p> <p>To provide knowledge about stock exchange</p> <p>To enable them with office equipments and system.</p> <p>To study about the organizations structures</p> <p>Processes underlying diversity within an organization .</p>

4	BC-104	English Language	6	<p>We frequently hear the fashionable phrase “good communication skills” widely bandid about these days. The greater the skills in speaking and writing,the grater the chances of success in many aspects of life ranging from friendships to business dealings.</p> <p>Students on completion of this course will be able to enhance their already learnt concepts in grammar like -parts of speech, uses of frequently confused articles , prepositions, common mistakes in writing.</p> <p>They will also become aware of how to write business letters , report writing, paragraphs writing, precis writing and comprehensions.</p>
2nd Semester				
5	BC-201	English Language	2	<p>On completion of this course students will reach to the threshold of proficiency in English communication skills. It will not only enable them to pass their examination exeditably but will also help them learn a subject that holds the key to their success in future.</p> <p>The significance of clear and effective communication in present age of globalization is self evident.</p> <p>Student at the end of this course will find a difference in their personal and professional interaction.</p> <p>They will become aware of the writing style of business letter ,note making, report writing, job application, cover letter, resume bio data, c.v.</p>
6	BC-202	Business Law	6	<p>To understand the concepts of business law and its importance.</p> <p>To understand the procedure of application of the business law in various aspects</p> <p>To understand basic knowledge about Indian Contract Act 1872.</p> <p>To know about Partnership act 1932 and LLP act 2008.</p> <p>To know about the basic knowledge of sale of goods act 1930.</p> <p>To know about the basic knowledge of Negotiable Instrument Act 1881</p>
7	BC-203	Business Statistics	6	<p>Understand Meaning and concepts of Statistics and different methods of presentation of Statistical data.</p> <p>Classification of different measures of central tendency and variations.</p> <p>Computation of simple correlation and regression which is comparing more than one set of data.</p> <p>Analysis the causes of variations in Time series.</p> <p>Application of statistics in business and economics.</p>
8	BC-204	Modern Hindi Language	6	<p>आधुनिक भारतीय भाषा: हिन्दी गद्य का उद्भव और विकास</p> <p>इस पाठ्यक्रम की समाप्ति पर छात्र हिन्दी गद्य साहित्य के बारे में सामान्य जानकारी प्राप्त कर सकेंगे। हिन्दी गद्य साहित्य का विभिन्न कालकमानुसार विकास को परिभाषित कर सकेंगे।</p> <p>छात्र हिन्दी गद्य की विभिन्न विद्याओं से परिचित हो सकेंगे।</p>

				छात्र हिन्दी गद्य साहित्य के मूर्धन्य साहित्याकार जैसे मुंशी प्रेमचन्द, यशपाल, कृष्णा सोबती, बालमुकुन्द गुप्त, भारतुन्दु हिरशचन्द, हरिशंकर परसाई एवं महादेवी वर्मा तथा इनके कृतियों से परिचित हो सकेंगे।
3rd Semester				
9	BC-301	Company Law	6	Classification of different types of Joint Stock Companies. Understanding memorandum of association, Articles of association and Prospectus. Knowledge on share capital, borrowing powers of companies. Awareness about directors, meeting and resolutions passed. Understand winding up of the company.
10	BC-302	Income Tax Law and Practice	6	To introduce the basic concept of Income Tax. In order to familiarize the different know-how and heads of income with its components. It helps to build an idea about income from house property as a concept. It give more idea about the income from business or profession.
11	BC-303	Modern Hindi Language	6	आधुनिक भारतीय भाषा: हिन्दी – हिन्दी इस पाठ्यक्रम के पूर्ण होने के उपरान्त छात्र आधुनिक भारतीय भाषा (संविधान की आठवीं अनुसूचि में वर्णित 22 भाषा) का सामान्य परिचय दें सकेंगे। हिन्दी साहित्य के आदिकाल, मध्यकाल एवं आधुनिक काल को उनकी प्रवृत्ति के आधार पर परिभाषित कर सकेंगे। भक्तिकालीन प्रमुख कवियों एवं उनकी रचनाओं से परिचित हो सकेंगे। रीतिकाल एवं आधुनिक काल के प्रमुख हिन्दी कवियों, उनकी प्रमुख रचनाओं एवं काल विशेष की प्रमुख प्रवृत्तियों की जानकारी प्राप्त कर सकेंगे।
12	BC-304	Computer Applications in Business	2	To introduce the students about basics of MS-Office. To provide practical knowledge exposure to MS-Word. To provide practical knowledge exposure MS-Excel To provide practical knowledge exposure MS-Power Point Develop the competence of database management To make them aware about information system concepts and features To provide knowledge about Hardware and Software Enable the students with data processing and modern electronic medium Develop the students about application of information system Create an awareness about security , threats and its protective measures
		Computer Applications in	2	Provide basic knowledge about handling the computer

		Business (Practical)		Provide knowledge of MSWord, MS Excel And MS PowerPoint Surfing of internet Knowledge about accounting package
4th Semester				
13	BC-401	Business Communication	6	To develop Communication skills and overall personality development of the students. To acquire skills in reading ,writing ,comprehension and communication ,as also to use electronic media for Business Communication . The effective use of various types of communication. Develop communication skills for the workplace Techniques to improving your presentation skills.
14	BC-402	Corporate Accounting	6	Enabling the students to understand the features of Shares and Debentures Develop an understanding about redemption of Shares and Debenture and its types To give an exposure to the company final accounts To provide knowledge on Valuation of Goodwill & Shares Enable the students to understand about amalgamation , absorption and external reconstruction Students can get an idea about internal reconstruction To introduce and develop knowledge of holding companies accounts To make them aware about accounts of banking companies Keep them aware about CashFlow Statement
15	BC-403	Cost Accounting	6	Aimed to familiarize the concept of cost accounting Helps to gather knowledge on preparation of cost sheet in its practical point of view To facilitate the idea and meaning of material control with pricing methods Develop the knowledge about remuneration and incentives To introduce the concept of overhead cost.
16	BC-404	E-Commerce	3	Understand the concept of E-Commerce and Describe the opportunities and challenges offered by E-Commerce Able to handle electronic payment technology and requirements for internet based payments Understand the categories of E-Commerceand understand

				the different applications of E-Commerce To understand and identify security issues of E-Commerce Understand the concept of WEB Based Business Understand the M-Commerce applications.
		E-Commerce (Practical)	1	Provide knowledge of Website Development Provide knowledge of online Transactions through E-Commerce sites
5th Semester				
17	BC-501	Principles of Marketing	6	To provide understanding of Marketing and the Market driven enterprise to differentiate market. Identify the basic approaches to formulate. Marketing strategy. Identify stages of the Market planning process. To know the overview of Management. To study planning procedure.
18	BC-502	Goods and Service Tax (GST)	6	It provides Knowledge to students regarding the laws and principal of taxation and custom laws It enhances there capabilities to understand the taxation prevailing in the current economic system It enhance there knowledge of taxation accounting of GST which is necessary for the current market system. Identify the characters of customs duty. Understand about tax Computation.
19	BC-503	Principles Of Micro Economics	6	Students able to think critically and formulate independent and well considered conclusion about economic issues and policies. Make rational decisions based on rudimentary marginal analysis. Understand market structures and Market power . Understand the demand analysis Students able to understand cost analysis. Students will able to understand knowledge of law of supply and demand.
20	BC-504	Entrepreneurship	4	Inculcate innovative ideas for their new initiatives. Manage their own/family business in skillful manner with new idea coping with fast changing requirements of the society. Work together collaboratively for the startup of their new business instead of waiting for white collar job. Communicate skillfully with government officials and financial institutes with full confidence.

				Ready their project for new venture after completion of their study.
6th Semester				
21	BC-601	Auditing And Corporate Governace	6	<p>This paper gives the knowledge of examines the principles and practices of internal and external auditing</p> <p>The students is capable in understanding the auditing as a component of recurrent and strategic activities, risk assessment, internal control, systems evaluation, forensic accountability, and contemporary audit issues and challenges.</p> <p>Described about the concept of auditing, types and methods of auditing.</p> <p>Acquired knowledge about vouching of cash & credit transaction, verification of assets and liabilities</p>
22	BC-602	Consumer Protection	6	<p>Students will have a comprehensive understanding about the existing law on Consumer Protection in India.</p> <p>Students will be conversant with major International Instrument on Consumer Protection.</p> <p>Students will be aware of the basic procedure for handling consumer dispute.</p> <p>Students will be able to appreciate the emerging questions and policy issues in consumer law for future research</p> <p>Students able to know the rights of consumer .</p> <p>Should able to know about the Ombudsman.</p>
23	BC-603	Indian Economy	6	<p>To impart the knowledge about objectives and economic planning in India.</p> <p>Mixes Economy and economic planning, development strategy in India, liberalisation, privatization and Globalisation.</p> <p>Providing exposure to basis of Indian Economy.</p> <p>To create student's ability to suggest of the various economic problems.</p> <p>To know the development process in India after independence.</p> <p>Should able to understand structures of economy.</p> <p>Importance causes and impact of population growth.</p>
24	BC-604	Seminar and Comprehensive Viva Voce	4	<p>To gain the experience of a interview before they go out seeking jobs in industry.</p> <p>To develop confidence in a face to face interaction in a formal setting.</p>

B.Sc. Forestry

Programme Code: 103

Programme Summary

Duration: 4 years

Eligibility

10+2 with at least 45% marks in PCB/PCM.

Program outcomes:

- To get acquainted with basics & principles of Plant Biochemistry, Biotechnology, Physiology, Botany, Cytology-genetics, Computers, Statistics and English.
- To understand the fundamentals of Hydrology, Geology and Soil science like chemistry and fertility of Forest soils, Sericulture, Environmental Science and Horticulture.
- To learn the ethnobotany along with medicinal and aromatic Plants and their uses and impacts on the tribal communities and remote villages using extension education concepts.
- To understand the effect of meteorology on crops production and weather forecasting models to cope up with the uncertainty of Indian weather conditions.
- To gain the preliminary knowledge on geographical distribution of grasslands, forests and their classification in the India and in the world. Critical examination of the world forest sources, productivity potential and increment of world forests.
- To learn the principles and practices of Silviculture, silvicultural and dendrological knowledge i.e. origin, distribution, general description, phenology, silvicultural characters, regeneration methods, silvicultural systems, tending operations and economic importance of important conifer and broad leaved tree species of India & also the nursery techniques of these tree species.
- To learn the Forest management skills for best growth of any forest and also to get acquainted with the Forest policies and the laws.
- To develop the skills to take-up forest mensuration exercises and ecological studies in the forested areas.
- To explore the anatomical studies of tree/woody perennials including monocot and dicot.
- The skills on tree-seed collection, seed storage, seed testing for purity, viability, moisture, germination etc will be developed in this program.
- To learn the principles & techniques of tree improvement i.e. selecting superior trees in natural stands and plantation, controlled crossing techniques, Vegetative propagation techniques, Pollen viability determination.
- It provides in depth information on logging operations in the forests, develop basic knowledge on chemical, physical, mechanical, electrical as well as sound related properties of timber, various treatments like seasoning of wood, preservation of wood and the utilization of the timber/wood collected in various industries.
- It imparts general idea about the use of wood as an engineering material for bridges, roads and building material.
- It also provides basic knowledge on the role and use of Remote Sensing in Forestry.
- To develop knowledge on methods of collection, extraction, classification, storage, uses, management and importance of Non-Timber Forest Products (NTFP) viz.- Fodder (grasses and tree leaves), canes and bamboos, essential Oils, non-essential oils, Gums and resins, Tans and dyes.

- To gain the knowledge on traditional & well designed Agroforestry systems, techniques, management and their advantages over sole cropping landuse systems.
- To develop the skills to identify and cure the diseases, insects, pests of the Forest trees.
- To explore about the wildlife and its management including habit & habitat of different wildlife, scientific names, behavior and adaptations of important wild species.
- To know about the basic concept of entrepreneurship and its development in forestry. Project planning, evaluation, Swot analysis.
- To become familiar with basic economic and business principles and how they can be applied to forestry. Utilize economic principles to address private and public policy issues related to allocating natural resources and environmental amenities.
- To develop skills to conduct various field based activities of forestry aspects.
- To develop aptitude for formulating research problem and experimental planning, data collection and statistical planning.
- To provide hands-on-trainings or Forestry work experience on Socio-economic surveys in villages, Forest Department attachments, Forest-based-Industrial attachment and Production and marketing of quality planting material.

Course outcomes:

S.no.	Course code	Course name	Credits	Course outcomes
1st Semester				
1	SOA/FC101T	Fundamentals of Geology & Soil science	2	<p>To explore about Composition of earth's crust, soil as a natural body major components by volume pedology rocks types Igneous sedimentary and metamorphic classification soil forming minerals. Definition classification – silicates, oxides, carbonates, sulphides, phosphates occurrence. Weathering of rocks and minerals, weathering factors: physical, chemical, biological agents involved, weathering indices, factors of soil formation, land forms parent, material climate organism, relief time soil forming processes eluviations and illuviation formation of various soils.</p> <p>To study about problem soils: salted soils, permeable, flooded, sandy soils properties. Physical parameters texture definition methods of textural analysis textural classes, absolute specific gravity definition apparent specific gravity/bulk density factors influencing field bulk density. Relation between BD. Pore space definition, factors affecting capillary and noncapillary porosity, soil colour definition, its significance, colour variable hue, value, chroma, Munsell colour chart, factors influencing parent material soil moisture organic matter, soil structure, types of structure, factors influencing genesis of soil structure. Soil air-air composition, amount of air space, soil air renewal, soil temperature sources and distribution of heat, chemical properties humus inorganic secondary silicate clay hydrous oxides.</p> <p>To Acquire knowledge about Soil organic matter decomposition, pH nutrient availability, soil buffering capacity, soil water forms, hygroscopic, capillary and gravitational, soil moisture constants, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, energy concepts, pF scale measurement-gravimetric, electric and tensiometer methods. Soil water movement, saturated and unsaturated infiltration and percolation. Soils of different eco-systems and their properties.</p>
2	SOA/FC101P	Fundamentals of Geology & Soil science- Practical	1	<p>To have a knowledge about Identification of rocks and minerals; Collection and preparation of soil samples; Soil analyses for moisture, color, bulk density, organic matter, pH, EC; textural analysis; study of soil profile I & II.</p> <p>To have field experience by excursions/ tours for identification of rocks and minerals and profile studies; practical introduction to tensiometer, pressure plate and neutron probe etc.</p>
3	SOA/FC102T	Plant Biochemistry and Biotechnology	2	<p>To understand the significance of Biochemistry.</p> <p>Describe the chemistry of carbohydrates, lipids, proteins and amino acids.</p> <p>Describe the classification and structural organization of proteins.</p> <p>Describe the mechanism of enzyme action and identify the classes of enzymes and factors affecting action.</p> <p>Describe the catabolic reactions of carbohydrates, lipids and amino acids.</p> <p>Understand Concepts, principles and processes in plant biotechnology.</p> <p>Identify the class and functions of secondary metabolites</p>

4	SOA/FC102P	Plant Biochemistry and Biotechnology- Practical	1	Students will be able to assay the compound qualitatively or quantitatively Determination of unknown compound. Develop skills for application of tissue culture techniques in tree improvement. To get knowledge about the plant tissue culture.
5	SOA/FC103T	Principles of Plant Physiology	2	To know about the metabolic activity and life, cycle of the plant from germination through growth and development. To know importance and scope of plant physiology. To understand the plants and plant cells in relation to water-osmosis, imbibitions, diffusion and water potential and the movement of sap and absorption of water in plant body, structure and function of stomata, opening and closing of stomata, different types of stresses- water, cold, heat, plant nutrition and essentiality and mechanism of absorption. To understand the process of photosynthesis particular light and dark reaction, respiration particular emphasis on aerobic and anaerobic respiration, photo-hormones.
6	SOA/FC103P	Principles of Plant Physiology- Practical	1	To learn about measurement of water potential by osmosis and plasmolysis method. To demonstrate the rate of transpiration by using Potometer. To learn demonstrate the importance of photosynthesis by the help of wilmonnt bubbler and inverted funnel exp. To study plant movement by the help of clinostat. To study separation of leaf pigments by paper strip chromatography. To study structure of stomata and role of stomata in transpiration by using four leaves exp.
7	SOA/FC104T	Statistics & Computer Application	2	Statistics: Basic Statistical concept. Average and measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles and quadrilles, for raw and grouped data. Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data. Probability concepts. Correlation & Regression. Test of significance. Computer Application: Introduction to computers and personal computers given. Basic concepts of hardware and software discussed. Input and output devices demonstrated. Operating system and its importance elaborated. Exposure to MS Office , MS word, MS PowerPoint and MS Excel have been provided.
8	SOA/FC104P	Statistics & Computer Application-Practical	1	As per the SOA/FC104T Practical case studies on MS Office practiced.
9	SOA/FAECC101T	Structural Grammer and Spoken English	1	Introduction to word classes; structure of the verb in English. Uses of tenses. Study of voice. Use of conjunctions and prepositions. Sentence patterns in English. Spoken English: conversations of different situations in everyday life. The concept of

				stress, stress shift in words and sentences.
10	SOA/FAECC101P	Structural Grammar and Spoken English- Practical	1	As per the SOA/FC101T
11	SOA/FE101T	Chemistry & fertility of Forest Soils	1	To explore the knowledge of Chemistry & fertility of Forest Soils and their importance. Scope, opportunities and constraints of soil and its chemistry. Introduction to Forest soils and cultivated soils. Properties of soils under different forest ecosystems. And also know the Essential nutrient elements-occurrence, availability and their functions.
12	SOA/FE101P	Chemistry & fertility of Forest Soils- Practical	1	To identify and study forest soil profile and Determination of available N, P & K content of soil.
13	SOA/FE103T	Introductory Botany	1	Introduction to Botany and general classification of plants. Structure and types of plant tissues. Internal Structure of Dicot and Monocot Stems, roots and leaf. Significance of life cycle with special reference to alternation of generations in <i>Chlamydomonas</i> , <i>Rhizopus</i> , <i>Funaria</i> , <i>Adiantum</i> , <i>Pinus</i> and a flowering plant.
14	SOA/FE103P	Introductory Botany- Practical	1	Studies of permanent slides of anatomy of stem root and leaf. Study of various plant parts. Survey to local area to study local vegetation.
15	SOA/FE104T	Sericulture	1	It provides exposure to the history of sericulture development and future scopes. Detailed study of mulberry and its cultivation practices in different climatic zones of country.
16	SOA/FE104P	Sericulture- Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FE104T.
2nd Semester				
17	SOA/FC105T	Principles of Hydrology, Soil- Water Conservation and wasteland	2	Students know basic terms used in hydrology. Students comprehend the hydrologic cycle and related major water quantity and quality challenges and their relevance to human health and well-being, ecosystems, and the food supply. Students understand the role of hydrology, water resources management. Students understand the principle of water flow in the nature. Students understand the structure and activities of various types of aquifers. Students know basic methods for measuring and analysing hydrologic parameters. Students understand the importance of water sources and know how to adequately protect them. Students understand the importance of soil and know how to conserve that. Students understand the concept of Wasteland and reclamation of wasteland.
18	SOA/FC105P	Principles of Hydrology, Soil- Water Conservation and	1	To impart practical knowledge and hands-on-training based on Course SOA/FC105T.

		wasteland- Practical		
19	SOA/FC106T	Principles of Cytology and Genetics	2	History of genetics and hypothesis-theories. Physical basis of heredity, cell reproduction mitosis-meiosis and their significance. Gametogenesis and syngamy in plants. Mendel's principles of heredity, deviation from Mendelian inheritance, Chromosome theory of inheritance, gene interaction: modification of monohybrid and dihybrid ratios. Multiple alleles, quantitative inheritance, linkage and crossing over, sex determination - theories, sex linked inheritance and characters. Cytoplasmic inheritance and maternal effects. Chemical basis of heredity: Structure of DNA and its replication. Evidences to prove DNA as genetic material. Mutation and its classification. Chromosomal aberrations: Changes in chromosome structure and number
20	SOA/FC106P	Principles of Cytology and Genetics-Practical	1	As per the SOA/FC106T
21	SOA/FC107T	Ethnobotany	2	Traditional ecological knowledge of wild plant to the society. To communicate and describes the healing uses of local plants. To experience the cultural contact of the healing and food local food production process. To describes and observe the use and role and importance of psycho active plant within their traditional contact. To identify local plants and scientific names and mythology of syllabus related families. Bring out the relevance of ethnobotany in the present context. Know about the major and minor ethnic groups or Tribal's of India, and their lifestyles. Learn about the methodology of Ethnobotanical studies. Gain knowledge on the role of role of ethnobotany in modern medicine. Get awareness on the conservation practices of medicinal plants.
22	SOA/FC107P	Ethnobotany-Practical	1	To learn about traditional local plants used as traditional medicine, as food, as fodder, as fiber etc. by local people. To visit various local places to collect information regarding traditional uses of plants. To study about identification of plants associated with mentioned families in syllabus. To study mythology of some common local plants.
23	SOA/FC108T	Medicinal and Aromatic Plants	2	To excel the knowledge of Medicinal and aromatic plants and their importance. Scope, opportunities and constraints of medicinal and aromatic plants. Origin, importance, distribution, production, climate, soil, water, plant protection, harvesting and use of important medicinal and aromatic plants. Endangered medicinal and aromatic plants of India and their conservation.
24	SOA/FC108P	Medicinal and Aromatic Plants- Practical	1	To identify different types of plants including tree, shrub and herbs in surrounding forest areas. Different processing methods of medicinal and aromatic plant products through industrial/ institute visits.
25	SOA/FC109P	Technique / field tour	1	Field tours to study the forestry field techniques.
26	SOA/FAECC102T	Environmental Science	1	Environment: introduction, definition and importance.

				<p>Components of environment -interactions with organisms. Global and Indian environment - past and present status.</p> <p>Environmental pollution and pollutants.</p> <p>Smog, acid rain, global warming, ozone hole, eutrophication, sewage and hazardous waste management.</p> <p>Impact of different pollutions on humans, organisms and environment.</p> <p>Introduction to biological magnification of toxins.</p> <p>Deforestation - forms and causes relation to environment.</p> <p>Prevention and control of pollution - technological and sociological measures and solutions - Indian and global efforts.</p> <p>India, international and voluntary agencies for environmental conservation - mandates and activities.</p> <p>International conventions and summits - major achievements.</p> <p>Environmental policy and legislation in India.</p> <p>Introduction to environmental impact assessment. Causes of environmental degradation - socio-economic factors.</p> <p>Human population growth and lifestyle.</p>
27	SOA/FAECC102P	Environmental Science- Practical	1	As per paper SOA/FAECC102P
28	SOA/FE105T	Fundamental of Extension Education	1	To explore about of extension forestry can be expressions of the end towards which our efforts are directed. And also with the help of extension education is the development of the rural people, and also to improve all aspects rural people lives within the framework of the national development policies and people's need for development.
29	SOA/FE105P	Fundamental of Extension	1	To learn about the structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/ Mahila Mandal, Village Panchayat, State Dept. of Forests/All India Radio (AIR).
30	SOA/FE106T	Fundamentals of Horticulture	1	<p>To study the Economic importance and classification of horticultural crops.</p> <p>To learn about the nutritive value of fruits and vegetables.</p> <p>To learn about the area and production of horticultural crops.</p> <p>To understand about the exports and imports of horticultural crops.</p> <p>To learn about fruit and vegetable zones of India and of different states.</p> <p>To understand the nursery management practices, soil and climate.</p> <p>To gain knowledge about vegetable gardens, nutrition and kitchen garden and other types of gardens.</p> <p>To understand the principles, planning and layout.</p> <p>To learn about the management of orchards.</p> <p>To understand the planting systems and planting densities.</p> <p>To gain knowledge about production and practices for fruit, vegetables and floriculture crops.</p> <p>To gain knowledge about nursery techniques and their management.</p>

				<p>To understand the principles and methods of pruning and training of fruit crops. To learn about the types and use of growth regulators in horticulture. To learn about water management, weed management and fertility management in horticultural crops. To study about bearing habit and factors influencing fruitfulness and unfruitfulness. To learn about the rejuvenation of old orchards, top working, frame working. To understand about the principles of organic farming</p>
31	SOA/FE106P	Fundamentals of Horticulture-Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FC106T
32	SOA/FE107T	Agrometeorology	1	<p>Students understand the role of meteorology for crop production. Students understand concepts of Weather & Climate and their significance for atmosphere. Students get the knowledge of different type of clouds. Students understand the science behind formation of cyclones and anticyclones. Students comprehend effect of Solar radiation on plant growth. Students know the concept of agroclimatic zones. Students get to know about global warming and impact on climate change. Students get to know the use of remote sensing in Agrometeorology.</p>
33	SOA/FE107P	Agrometeorology-Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FC107T
3rd Semester				
34	SOA/FC110T	Logging and Ergonomics	2	<p>To learn about and scope of logging, study of logging plan and execution. Study of Location and demarcation of the area for logging and estimation of produce available for extraction. Study of Implements used in logging operation- traditional and improved tools. Study of Felling rules and methods. Conversion. Study about various means of transport of timber- carts, dragging, skidding, overhead transport, ropeways, and skylines. Transport by road and railways. Transport by water- floating, rafting and concept of booms. Study of Grading and Storage of timber in the depots for display and disposal. Timber Depots- types, lay out and management. Study of Systems of disposal of timber. Study of Ergonomics, components and provision of energy. Requirement of energy and rest periods. Effect of heavy work, posture, weather and nutrition. Study of Personal protective equipments, safety helmets, ear and eye protections. Accidents: causes, safety rules and first aids.</p>
35	SOA/FC110P	Logging and Ergonomics-Practical	1	Field study of Survey and demarcation of area intended for logging and listing of permanent boundary marks; Marking of trees for logging operation and preparation of marking list.

				<p>Study of Equipments and tools used in logging operations and their uses.</p> <p>Study of Planning and execution of different logging operation in a phase wise manner;</p> <p>Study of Application of felling rules in the forests for felling of standing trees at different localities.</p> <p>Study of Instructions regarding maintenance of various records and registers in logging operations.</p> <p>Study of Conversion of felled trees into logs, poles, firewood, pulpwood etc.</p> <p>Measurement of logs, poles and firewood in forests and maintenance of records in relevant registers.</p> <p>Minor and other types of transport practicable at felling sites;</p> <p>Study of Final transport, information regarding transit permits for various types of forest produce;</p> <p>Visit to local dumping yard (timber depot) to trace the logs delivered from different forest sites;</p> <p>Study of Sorting of logs, poles and firewood in the depots according to species, quality, length and girth classes; Study of Stacking and stock checking of different logs, poles and firewood in the depots so as to confirm that all the converted materials in the forests have reached their destination.</p> <p>Study of Recording of the lots for auction sale. Final disposal of the material; Visit during the auction sale in the government timber depots;</p> <p>Study of Preparation of ergonomic check lists.</p>
36	SOA/FC111T	Soil Survey, Remote Sensing	2	<p>Scope and objective; soil survey, sampling methods; planning, inventory, permanent sample plots; sample size allocation, landuse classes and planning.</p> <p>Soil survey – classification–aerial photography–satellite–their interpretation, land-capability-classification.</p> <p>Aerial photography and remote sensing–definition, meaning, scope, merits and brief history.</p> <p>Electromagnetic spectrum; radiations, differential reflections by surfaces, active and passive remote sensing, earth observation satellites. Equipment and materials–aerial bases, cameras, filters, stereoscopes, computers, radars.</p> <p>Photogrammetry: Vertical and oblique photography. Photographs and images, scales, resolution, photo interpretation, photogrammetry, image analysis, mapping.</p> <p>Agencies involved in remote sensing and acquiring information from them.</p> <p>Remote sensing; principles, uses in forestry, vegetation / cover classification and mapping, species identification, height and volume – estimation. Identification of tree species and their form stand delineation.</p> <p>Interpretation of land forms and soils; use of micro-level survey of farm forests, large scale photos in forest inventory, site selection. Imagery and image analysis – video satellite, computer and radars. Geographic Information systems- Computer softwares used.</p>
37	SOA/FC111P	Soil Survey, Remote Sensing -Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FC111T
38	SOA/FC112T	Forest Mensuration	2	To understand different techniques to calculate parameters of tree like diameter, girth, age

				etc; Understanding and use of instruments used in forest mensuration. To prepare volume table concept of forest inventory and sampling techniques. <u>Application of Remote Sensing</u>
39	SOA/FC112P	Forest Mensuration- Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FC112T
40	SOA/FC113T	Forest Engineering & Survey	2	Basic knowledge of types of survey and related instruments. Concept and design of forest roads and building materials. Design of bridges.
41	SOA/FC113P	Forest Engineering & Survey-Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FC113T
42	SOA/FC114P	Technique / field tour	1	Field tours to study the forestry field techniques.
43	SOA/FSEC101T	Tree Seed Technology	1	To learn about Seed and its importance. Study of Role of seed technology in nursery stock production. Study of Production of quality seed, identification of seed collection areas-seed orchards – maintenance of genetic purity-isolation and rouging, seed study of source (provenance and stands). Study of Selection of seed tree (genotypic and phenotypic selection), plus tree (pure stands, elite seed tree, isolated tree and their location). Study of Seed Collection – Planning and Organization, Collection methods, Factors affecting seed collection, Study of Seed maturity and tests. Seed Study of processing – Seed extraction, drying, blending, cleaning, grading, treating, bagging, labeling and storage. Study of seed Storage – orthodox, intermediate and recalcitrant seeds, precautions of handling of recalcitrant seeds, natural longevity of tree seeds, factors affecting longevity. Study of Seed testing (sampling, mixing and dividing, determination of genuineness, germination, moisture, purity, vigour, viability). Seed Study of seed dormancy, classification and breaking of seed dormancy. Study of Different viability and vigour tests, seed pelleting, seed health. Classes of tree seeds, study of seed certification and procedures of tree seeds certification.
44	SOA/FSEC101P	Tree Seed Technology- Practical	1	Identification of seeds of tree species; Seed Study of maturity tests; Physical purity analysis; Determination of seed moisture; Seed germination test; Hydrogen peroxide test; Study of Tetrazolium test for viability; Seed vigour and its measurements; Identification of seed dormancy and methods of breaking dormancy in tree seeds; Testing membrane permeability; Study of seed collection and equipments; Study of Planning of seed collection; Seed collection; Seed extraction; Visit to seed production area and seed orchard;

				Visit to seed processing unit/testing laboratory; Study of seed sampling equipments.
45	SOA/FE109T	Wood Anatomy	1	To explore the anatomical studies of tree including monocot and dicot. Plant cell and tissue and types. Stem root and leaf anatomical studies. Mechanism of secondary growth and its importance. Early wood and late wood formation. Sapwood and heart wood and abnormal secondary growth in plants. Micro- and macro properties of wood.
46	SOA/FE109P	Wood Anatomy- Practical	1	To learn Microscopic studies of meristem, simple and complex tissue. Anatomical features of stem root and leaf.
47	SOA/FE110T	Tree Physiology	1	To learn about tree structure, growth, development, differentiation and reproduction. Plant growth functions and growth kinetics, will increase their identification skill. To explore about Physiological functions and processes in trees. To study the role of environmental effects on growth and development. To highlight the students about light use efficiency in forest species, canopy structure, plant phyllotaxis and its importance in translocation. Plant light relationship. LAI, Photosynthetic efficiency and respiratory losses, source sink relationship, Factors affecting photosynthesis. Radiation interception. The content will definitely help the forestry students to know the forest environment and conducive conditions for the same. To study transport processes with special reference to long distance transport in trees and its impact on plant water relations and photosynthesis. Biocides and growth regulators in forest ecosystems. Senescence and abscission. Role of trees in pollution control.
48	SOA/FE110P	Tree Physiology- Practical	1	To study about various physiological process of tree like growth, translocation of food, source and sink, effect of growth hormones and senescence in trees.
49	SOA/FE111T	Introductory Forest Economics	2	The students will be able to understand Nature and scope of economics and also its relationship with other sciences. The students will be able to state the various theories related to consumer behavior such as equi-marginal utility, indifference curve, diminishing marginal utility. The students will be able to define law of demand and understand the concept of price, income and cross elasticity's. The students will be able to explain factors of production i.e. land, labour, capital and enterprise. The students will be able to describe Law of diminishing marginal returns. The students will be able to explain the Law of supply. The students will be able to explain the theories of rent, wage, interest and profit. The students will be able to understand the concepts of Price determination and forecasting under various market structures. The students will be able to understand the concepts of National Income. The students will be able to describe the concept and types of inflation.
4th Semester				
50	SOA/FC115T	Principles and Practices of Silviculture	2	To learn about forestry and silviculture by studying definition of forest and forestry. Classification of forest and forestry, branches of forestry and their relationships.

				<p>Definition, objectives and scope of Silviculture. Status of forests in India and their role. History of forestry development in India. Site factors - climatic, edaphic, physiographic, biotic and their interactions. Classification of these factors and their influence on Forest Production. Impacts of controlled burning and grazing. Influence of forests on environment. To acquire knowledge about Trees and their distinguishing features. Growth and development. Forest reproduction - flowering, fruiting and seeding behaviour. Natural, artificial and mixed regeneration. Natural regeneration - seed production, seed dispersal, germination and establishment. Requirement for natural regeneration. Dieback in seedling with examples. Plant succession, competition and tolerance. Forest types of India and their distribution.</p>
51	SOA/FC115P	Principles and Practices of Silviculture-Practical	1	To learn about forest composition, phenotypic characters of the trees, growth rings and forest succession in different forest types of Dehradun.
52	SOA/FC116T	Wood Science and Technology	2	<p>To study kinds of wood and its properties as a raw material. To get knowledge of physical, strength, electrical, acoustic and thermal properties. To understand the relation between use of wood and the properties of wood. To study wood-water relationship. Detailed study of the treatments can be given to wood to increase its life for different uses. To study the timber classification on the basis of durability and refractory nature. To study the processing defects and its effect in woods utilization.</p>
53	SOA/FC116P	Wood Science and Technology- Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FC116T
54	SOA/FC117T	Silviculture of Indian Trees	2	<p>Study of Origin, distribution, general description, phenology, silvicultural characters, regeneration methods, silvicultural systems and economic importance of the following conifer and broad leaved tree species of India. Conifers: <i>Abies pindrow</i>, <i>Picea smithiana</i>, <i>Cedrus deodara</i>, <i>Pinus roxburghii</i>, <i>Pinus wallichiana</i>, <i>P. gerardiana</i> and <i>Juniperus spp.</i> Broad leaved species: <i>Tectona grandis</i>, <i>Shorea robusta</i>, <i>Acacia spp.</i>, <i>Dalbergia sissoo</i>, <i>D.latifolia</i>, <i>Quercus spp.</i>, <i>Robinia pseudoacacia</i>, <i>Alnus spp.</i>, <i>Anogeissus spp.</i>, <i>Populus spp.</i>, <i>Eucalyptus spp.</i>, <i>Casuarina equisetifolia</i>, <i>Terminalia spp.</i>, <i>Santalum album</i>, <i>Swietenia mahagony</i>, <i>Albizia spp.</i>, <i>Prosopis spp.</i>, <i>Pterocarpus santalinus</i>, <i>Azardirachta indica</i>, <i>Diospyros melanoxylon</i>, <i>Madhuca indica</i>, <i>Leucaena leucocephala</i> and Bamboos.</p>
55	SOA/FC117P	Silviculture of Indian Trees-Practical	1	<p>Study of species composition in surrounding areas. Study of morphology and phenology of tree species growing in the area. Study of artificial regeneration of Pines, Bamboo, Oak, <i>Dalbergia sissoo</i> and <i>Acacia catechu</i>, etc. Practicing thinning in Bamboo clumps. Study on tree responses to the abiotic and biotic</p>

				factors viz., light, fire, drought, frost, root suckering, coppicing and pollarding, etc. To study quality characters of nursery planting stock.
56	SOA/FC118T	Forest Pathology	2	History and importance of forest pathology in India and the world. Relation of plant pathology with forest pathology and other sciences, classification of tree diseases. Role of microbes and fungi in a natural forest ecosystem. Broad classification of different pathogens causing tree diseases. General characteristics of fungi, bacteria, viruses, mycoplasma and phanerogames. Important characters of ascomycetes and basidiomycetes. Growth and reproduction of plant pathogens, infection and factors influencing disease development. Dissemination and survival of plant pathogens. Distribution, economic importance, symptoms, etiology and management of the following. Diseases of important tree species like teak, <i>Dalbergia</i> spp., <i>Acacia</i> spp., neem, <i>Cassia</i> , sal, <i>Albizia</i> , <i>Terminalia</i> , mango, jack, pines, deodar, eucalyptus, bamboo, casuarina, rubber, sandal wood, medicinal and aromatic plants grown in different Agroforestry systems. Biodegradation of wood in use. Types of wood decay, gross characters of decay, sapstain, different types of rots in hardwoods, softwoods and their prevention. Graveyard test and decay resistant woods. Principles, definition and scope of forest disease management in forestry. Importance of disease cycle and economic threshold in disease management. Principles of disease management. Nature of disease resistance. Nursery diseases of important forest species. Fungicides and their use in nurseries and plantations. Integration of cultural, chemical, biological and host resistance in disease management.
57	SOA/FC118P	Forest Pathology- Practical	1	To impart practical knowledge as per the course SOA/FC118T
58	SOA/FC119P	Technique/ Field tour	1	Field tours to study the forestry field techniques.
59	SOA/FSEC102T	Nursery Management & Commercial Forestry	1	To explore about the nursery site, its selection and layout. Different types of nurseries and the intercultural operation. Macro and micro propagation. Plant protection measures in nursery. Important tree species and their nursery practices.
60	SOA/FSEC102P	Nursery Management & Commercial Forestry- Practical	1	To explore about the nursery site, preparation of beds, sowing methods, treatment of seeds, intermediate operations for management of nursery. Study of vegetative propagation methods.
61	SOA/FE112T	Forest Ecology	1	To impart knowledge about ecology and the components of ecology, energy flow in ecology and parameters of population and community.
62	SOA/FE112P	Forest Ecology-Practical	1	To learn about the methods of studying the ecology at population and community levels by visiting different ecosystem.
63	SOA/FE113T	Fundamentals of Wild	1	To explore about the wildlife and its management. Different habitat type of wildlife.

		Life		Biological basis of wildlife. Different agencies involved in wildlife sector. Wildlife ecology. Basic requirements of wildlife. Importance of wildlife in existing biodiversity globally and in India.
64	SOA/FE113P	Fundamentals of Wild Life-Practical	1	To learn about the habit of different wildlife regarding to their food and habitat. Scientific names of important wild species. Wildlife behavior and adaptations.
65	SOA/FE114T	Wood Products & Utilization	1	To explore the knowledge of paper industry, pulp and paper making, different types of papers, types of paper boards and plywood industry to study the manufacturing processes. To learn about the wood based industries, wood distillation unit.
66	SOA/FE114P	Wood Products & Utilization-Practical	1	Visits to various wood based industries to demonstrate various wood products manufacturing process.
5th Semester				
67	SOA/FC120T	Rangeland Management	2	To explore about the Key management components seek to optimize such goods and services through the protection and enhancement of soils, riparian zones, watersheds, and vegetation complexes, sustainably improving outputs of consumable range products such as red meat, wildlife, water, wood, fiber, leather, energy resource extraction,
68	SOA/FC120P	Rangeland Management-Practical	1	To learn about identification of grasses, forbs and legumes and fodder trees; Rangeland inventory – ground cover, plant height, relative dominance, etc.; Assessing nutrient; Estimating range condition from plant composition; Determine range utilization, carrying capacity of rangelands;
69	SOA/FC121T	Silvicultural Systems	2	To understand scope/need of silvicultural systems Detailed study of creation and management of various silvicultural systems.
70	SOA/FC122T	Experimental techniques in Forestry	2	Introduction to scientific methodology. Measurement and scaling techniques. Measures of central tendency and dispersion, introduction to distributions. Tests of Significance -'z' test,'t' test and 'F' test. Principles of field experimentation. Comparison between field and forestry experimentation. Design and analysis: Completely randomized design, Randomized complete block design, Latin square design and split-plot design, normalization of data. Concept of factorial experiments. Sampling - Concept of population and sample, advantages of sampling and methods of sampling. Models in Agroforestry research. Site selection, size, layout and shape of the plot, arrangement of blocks in traditional forestry and Agroforestry. Instrumentation in forestry research (for soil analyses, plant analyses). Development of a research plan. Research planning in Forestry in India. Scientific literature search / retrieval and scientific writing.
71	SOA/FC122P	Experimental techniques in Forestry-Practical	1	As per the Paper SOA/FC122T

72	SOA/FC123T	Dendrology	2	<p>Introduction – importance and scope of dendrology.</p> <p>Classification of plants-Bentham and Hooker’s, Engler and Prantles, and Hutchinson’s Systems.</p> <p>Plant Nomenclature – objectives, principles and International Code of Botanical Nomenclature.</p> <p>Herbarium techniques, collection, processing and preservation of plant material. General study of herbarium, arboretum and Xylarium.</p> <p>Description of the plant in scientific terms, study of sport characteristics of plants, naming and classifying based on adopted system.</p> <p>Study of families, as survey of forest resources: Magnoliaceae, Rhizophoraceae, Ebenaceae, Sapotaceae, Fabaceae, Santalaceae, Elaeagnaceae, Meliaceae, Salicaceae, Apocynaceae, Betulaceae, Verbenaceae, Fagaceae, Asteraceae, Moraceae, Poaceae, Tiliaceae, Liliaceae, Euphorbiaceae, Myrtaceae, Glusiaceae, Dipterocarpaceae, Cupressaceae, Guttiferae, Taxaceae, Pinaceae and Combretaceae.</p> <p>Geographical distribution of important Indian trees, native trees, exotic trees, endemism.</p>
73	SOA/FC123P	Dendrology-Practical	1	Study of woody flora of families mentioned in theory.
74	SOA/FC124T	Wild life Management	2	To extend the view of wildlife regarding to management and wildlife survey. Wildlife population dynamics. Prey predators relationships. Management of basic requirements. Conservation of biodiversity at national and international level. Political role
75	SOA/FC124P	Wild life Management-Practical	1	To exercise of wildlife study in captivity and nature. Visit learning at different protected areas.
76	SOA/FSEC103T	Plantation Forestry	1	To explore about the plantation needs and its significance. Preparation of plantation site, tools used for different preparation of plantation area. Different methods of planting practices. Industrial plantation. Wastelands and their reclamation.
77	SOA/FSEC103P	Plantation Forestry-Practical	1	To study of tools used for preparation of plantation. Layout of plantation sites. Protection measures for established plantation. Planting design.
78	SOA/FE115T	Fundamental Forest Business Managements	1	<p>Farm management-scope and approaches discussed.</p> <p>Cost-concept, principles and functions its relevance to business demonstrated.</p> <p>Basic laws of production explained.</p> <p>Principles involved in farm management decision making decision as to what, how, when and how much to produce described.</p> <p>Factor- factor-product and product-product relationships displayed.</p> <p>Cost of cultivation and production calculated.</p> <p>Break-even analysis discussed.</p> <p>How to do decision making under risk and uncertainty discussed.</p> <p>Farm business efficiency measures elaborated.</p> <p>Economic order quality and ABC analysis done.</p> <p>Management of resources-land, labour, capital and machinery described.</p>

79	SOA/FE115P	Fundamental Forest Business Managements- Practical	1	To study: Principles involved in farm management decision making decision as to what, how, when and how much to produce. Factor- factor-product and product-product relationships. Cost of cultivation and production. Break-even analysis. Principles involved in farm management decision making decision as to what, how, when and how much to produce. Factor- factor-product and product-product relationships. Cost of cultivation and production. Break-even analysis.
80	SOA/FE116T	World Forestry Systems	2	To study about Geographical distribution of forests and their classification. Critical examination of the world forest sources, productivity potential and increment of world forests. To learn about Forest resources and forestry practices in different regions of the world – North and South America, Europe, Africa, China, Japan, Russia, South-East Asia and Australia. To study about Forest development and economy – forest based industries of the world. To learn about Recent trends in forestry development in the world. To study about International forestry organizations.
81	SOA/FE117T	Forest Entomology & Nematology	1	To understand classification, biology, natural history and diversity of insects affecting forest ecosystems. To identify insects common to forests and recognize their damage. To appreciate insect sampling in forest ecosystems, with particular attention paid to monitoring, forecasting and assessing the risk of insect outbreaks. To illustrate the importance of silvicultural practices and management of natural enemies in preventing insect outbreaks. To recognize the importance of cultural, physical, biological, and chemical strategies for preventing, controlling and managing forest pests. To foster an appreciation for the significance of research on insect pests of forests. To understand the morphology of nematodes as it relates to their taxonomic position, their ability to cause diseases of plants and the principles of controlling nematode diseases of plants.
82	SOA/FE117P	Forest Entomology & Nematology-Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FE117T
6th Semester				
83	SOA/FC125T	Forest Management, Policy and Legislation	2	To study about the management aspects of forestry, yield regulations, rotation, legal aspects related to forestry and working plan. Sustained yield and normality in forestry.
84	SOA/FC125P	Forest Management,	1	To acquire knowledge by visiting forest departments and learning about the records they

		Policy and Legislation- Practical		maintain in the department, formation of working plan and legal aspects they use
85	SOA/FC126T	Principles and Methods of Tree Improvement	2	<p>Introductory study about forest genetics, tree breeding and improvement, Study of history of tree improvement, justification for tree improvement programme, its relation with other disciplines of forest management; activities, advantage and limitation of tree improvement.</p> <p>To learn about Forest reproduction and natural variation: sexual and asexual reproduction and their consequences.</p> <p>Study about Causes and kinds of variability, variation in natural stands, concepts, evolutionary forces that force variations and level of genetic variation; conservation and utilization of forest tree genetic resources- principle & strategies.</p> <p>Learn about quantitative genetics and importance of statistical methods in it, study about selection procedures and techniques in tree improvement, species and provenance selection, Plus tree selection and progeny trials. Study about Introduction to exotic forestry. Learn about seed production areas and seed orchards.</p> <p>Study about Hybrid in tree improvement; mutation and polyploidy breeding. Study about recent techniques in tree improvement, Learn about vegetative propagation and tree improvement.</p>
86	SOA/FC126P	Principles and Methods of Tree Improvement- Practical	1	<p>Study about Seed collection and handling of forest seeds.</p> <p>Learn about Techniques of selecting superior trees in natural stands and plantation. Floral biology and controlled crossing techniques.</p> <p>Study about Vegetative propagation techniques.</p> <p>Learn about Pollen viability determination. Visit to seed production areas and seed orchards.</p> <p>Study about Numerical exercises and statistical analysis.</p>
87	SOA/FC127T	Utilization of Non- timber Forest Products	2	<p>Learn about various methods of collection, management and importance of Non-Timber Forest Products (NTFP) viz.- Fodder (grasses and tree leaves), canes and bamboos. Essential Oils - methods of extraction, classification, storage and uses. Non-essential oils – nature, occurrence, methods of extraction, classification and uses. Important fixed oil yielding trees. Gums and resins –definition, classification, sources, collection and uses. Factors affecting gum formation. Important gum yielding plants. Resins and Oleoresins, their formation in plants and classification of resins. Tans-nature, classification, uses and important tannin yielding plants. Dyes – classification and sources of dyes. Beedi leaves – sources, collection and processing. Fibers and flosses. Katha and Cutch –sources, extraction and uses. Drugs, wild fruits, spices, poisons and bio-pesticides.</p>
88	SOA/FC127P	Utilization of Non- timber Forest Products- Practical	1	<p>Visit to nearby forests to study important NTFP yielding plants. Study of fodder: grasses and tree leaves. Study of canes and bamboos and their sources. Study of essential oils and their sources.</p> <p>Study of non-essential oils and their sources. Study of gums and resins and their collection.</p>

				Study of tans and dyes and their sources. Study of fibers, flosses and their collection from nearby forests. Visit to Herbal Gardens and herbaria to study medicinal plants. Study of plants yielding drugs, spices, wild fruits, poisons and bio-pesticides and their collection from nearby forests. Visit to nearby extraction units.
89	SOA/FC128T	Agroforestry Systems and Management	2	Introduction and classification of Agroforestry system. To learn about various traditional as well as modern agroforestry systems. To know the characteristic and role of various components of agroforestry systems. Impact of argoforestry practices in society, industries and environment.
90	SOA/FC128P	Agroforestry Systems and Management- Practical	1	To conduct the Agroforestry surveys. To identify various Agroforestry systems. To measure volume, biomass, tree dimensions of Agroforestry interest. To do soil analysis.
91	SOA/FC129P	Technique / field tour	1	Field tours to study the forestry field techniques.
92	SOA/FSEC104T	Entrepreneurship Development and Communication Skills	1	Assessing overall business environment in the Indian and managerial economy done. Concept of entrepreneurship and entrepreneurial characteristics discussed. Managing an enterprise and its skills displayed. Motivation and its types. Importance of planning, monitoring, evaluation and follow up discussed. Managing competition is an art and discussed how? Entrepreneurship development programs conducted. SWOT analysis explained. Government schemes and incentives for promotion of entrepreneurship discussed. Government policy on Small and Medium Enterprises (SMEs) / SSIs displayed. Export and Import Policies relevant to forestry sector and its case studies discussed.
93	SOA/FSEC104P	Entrepreneurship Development and Communication Skills- Practical	1	Field surveys. Market case studies. Interviews.
94	SOA/FE118T	Principles of Forest Economics, Project Planning and Evaluation	1	To become familiar with <i>economics</i> and business principles and how they can be applied to <i>forestry</i> . Utilize economic principles to address private and public policy issues related to allocating natural resources and environmental amenities.
95	SOA/FE118P	Principles of Forest Economics, project Planning and Evaluation-Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FE118T
96	SOA/FE119T	Marketing and Trade of Forest Produce	1	Demonstrate a basic knowledge of the role of markets and market failure with regards to the allocation of natural resources and environmental amenities.

				To familiar with the role of market channels for distribution of forest resources. To understand the concept of different types of market Students get to know about WTO & IPR.
97	SOA/FE119P	Marketing and Trade of Forest Produce-Practical	1	To impart practical knowledge and hands-on-training based on Course SOA/FE119T
98	SOA/FE120T	Biodiversity & Conservation	1	To explore about the biodiversity and its conservation at local as well as global level. Basic terms about biodiversity and its conservation. Diversity and its analytical features, different life forms under diversity. Conservation biology and its principles. Methods of conservation. Conservation efforts by India and worldwide.
99	SOA/FE120P	Biodiversity & Conservation-Practical	1	To exercise of diversity indices computation , visit of protected areas, case study regarding conservation.
7th Semester				
100	SOA/FC130P	Socio-economic surveys -village Attachment (28 working days)	4	To prepare survey questionnaire for socio-economic survey. To conduct the socio-economic surveys for data collection of relevance.
101	SOA/FC131P	Attachment with State Forest Department (70 working days)	10	To understand the construction of modern forest nurseries, herbal gardens and watersheds. To see and understand the procedure of the felling and logging operations, timber lots and important industrial products extraction with the use of Forestry equipments/ instruments. To see the working plan document of variuos Forest divisions and get to know enumeration, volume and yield calculation & compartment history To study the 'CAT' (Catchment Area Treatment Plan) and FDA (Forest Development Agencies) To study the regeneration and management of important forestry tree species. To conduct layout studies, stump analysis, preparation of local volume table.
102	SOA/FC132P	Industrial Placement (28 working days)	4	To get acquainted with the nature, working environment, production and management process and Marketing & financial management various of wood-based industries.
103	SOA/FSEC105T	Report Writing and Presentation of FWE (14 Working days)	2	To learn the compilation of the workdone/skills gained. To learn the data processing/ analysis. To develop the skill of Presentation of the report.
8th Semester				
104	SOA/FC133P	Project Development (2 weeks)	2	To develop the skill of project development to carry out any research activity.
105	SOA/FC134P	Collection, Handling, Processing and Storage of planting material (3 weeks)	2	To identify the superior seed sources. To use various seed collection methods for different species on field. To put seeds under various seed treatments to document their quality and regeneration potential. To understand the methods of storage of collected planting materials.
106	SOA/FC135P	Vegetative Propagation under controlled and	3	To apply vegetative propagation methods like cutting, grafting for propagation of forest trees, medicinal plants and fruit trees.

		ambient conditions (3weeks)		Production of bare root and containerized seedlings.
107	SOA/FC136P	Nursery Management (11 Weeks)	9	Practical application of the nursery management practices like seedbed preparation, sowing, planting, irrigation, polyhouse management, various intercultural operation.
	SOA/FSEC106P	Marketing of seeds and seedlings (2weeks)	2	To understand the marketing channels and links. To grade the planting stocks on the basis of quality and do pricing for them
108	SOA/FSEC107P	Cost Benefit analysis, Project Report & Presentation (1 week)	2	To get acquainted with the economic analysis of projects. To sharpen the skills of documentation of the field studies. To sharpen the skill of Presentation of research projects.

B.Sc. Horticulture

Programme Code: 105

Programme Summary:

Duration 4 years; 8 semesters

Eligibility

10+2 with minimum 45% marks in aggregate with PCB/PCM.

Program outcomes:

- To study vegetable farming systems, orchard planting systems, water and weed management in fruit, vegetable and flower crops.
- To know the physiology of the plants and application of growth regulators or bioregulators in the horticultural crops
- To study the production, propagation, breeding and seed production, aspects of tropical, sub-tropical and temperate fruits, vegetables, flowers, spices, condiments and medicinal and aromatic crops.
- To know the genetic diversity among the various horticultural crops.
- To enhance the communication skills and command on spoken english.
- To learn the different aspects of statistics and its application in the horticultural plants through the calculation as well as computation of data received from the field.
- To study the basics of the agronomical crops and fundamentals of soil science.
- To know about the plants and animals and their classification as well as characterization.
- To study the introduction of various types of microbes, insects, pathogens, nematodes etc. and their genetic make up, with aim of identification and control in horticultural crops.
- To know the importance, application (biofertilizers, bio-agents, vermicompost and soil amendments) and certification procedure for organic farming.
- To understand and calculate the economics or cost of cultivation of the horticultural crops to the growers or farmers.

Course Outcomes:

S.No.	Course code	Course name	Credits	Course outcomes
1st Semester				
1	SOA/HC 101 T	Fundamentals of Geology and Soil Science	2+1	<p>To study composition of earth's crust, soil as a natural body major components by volume pedology rockstypes Igneous sedimentary and metamorphic classification soil forming minerals.</p> <p>To study the definition classification - silicates, oxides, carbonates, sulphides, phosphates occurrence.</p> <p>To know the weathering of rocksand minerals, weathering factors: physical, chemical, biological agents involved, weathering indices,factors of soil formation, land forms parent, material climate organism, relief time soil forming processes eluviations and illuviation formation of various soils.</p> <p>To understand the problem soils: salted soils, permeable, flooded, sandy soils properties. Physical parameters texture definition methods of textural analysis textural classes, absolute specific gravity definition apparent specific gravity/bulk density factorsinfluencing field bulk density.</p> <p>To study the relation between BD.PD Practical Problem. Pore space definition, factors affecting capillary and noncapillary porosity, soil colour definition, its significance, colour variable hue, value, chroma, Munsell colour chart, factors influencing parent material soil moisture organic matter, soil structure, types of structure, factors influencing genesis of soil structure.</p> <p>To study about Soil air , air composition, amount of air space, soil air renewal, soil temperature sources and distribution of heat, chemical properties humus inorganic secondary silicate clay hydrous oxides.</p> <p>To know the soil organic matter decomposition, pH nutrient availability, soil buffering capacity, soil water forms, hygroscopic, capillary and gravitational, soil moisture constants, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, energy concepts, pF scale measurement-gravimetric, electric and tensiometer methods. Soil water movement, saturated and unsaturated infiltration and percolation. Soils of different eco-systems and their properties.</p>
2	SOA/HC 102 T	Elementary Plant Biochemistry and Biotechnology	2+1	<p>Understand the significance of Biochemistry</p> <p>Describe the chemistry of carbohydrates, lipids, proteins and amino acids</p> <p>Describe the classification and structural organization of proteins</p> <p>Describe the mechanism of enzyme action and identify the classes of enzymes and</p>

S.No.	Course code	Course name	Credits	Course outcomes
				factors affecting action Describe the catabolic reactions of carbohydrates, lipids and amino acids Understand Concepts, principles and processes in plant biotechnology. Identify the class and functions of secondary metabolites
3	HC103T	Principles of Plant Physiology	2+1	To know about the metabolic activity and life, cycle of the plant from germination through growth and development. Know importance and scope of plant physiology. Understand the plants and plant cells in relation to water-osmosis, imbibition , diffusion and water potential and the movement of sap and absorption of water in plant body, structure and function of stomata, opening and closing of stomata, different types of stresses- water, cold, heat, plant nutrition and essentiality and mechanism of absorption. Understand the process of photosynthesis particular light and dark reaction, respiration particular emphasis on aerobic and anaerobic respiration, photo-hormones.
4	SOA/HC 104T	Statistics and Computer application	2+1	To know the basic concepts of Variable statistics, types and sources of data, classification and tabulation of data, construction of frequency distribution, tables, graphic representation of data, simple, multiple component and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve. To calculate average and measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles and quadrilles, for raw and grouped data. To know the concept of dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data. To understand the probability: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poison and normal distributions. Correlation: Scatter diagram, correlation co- efficient and its properties, regression, fitting of simple linear regression. To know the test of significance: Basic concepts, Test of equality of one mean, Chi-square test for application of attributes and test for goodness of fit The outcome was mixture of practical and theoretical explanation of topics concerning computational and statistical approaches. Basics of computer, its input output devices, operating system and programming languages elaborated. Databases to handle data with reference to Horticulture were also discussed.
5	SOA/HAECC 101 T	Structural Grammar and	1+1	To study about the introduction to word classes; structure of the verb in English. To study the uses of tenses.

S.No.	Course code	Course name	Credits	Course outcomes
		spoken English		<p>To understand the study of voice.</p> <p>To study the uses of conjunctions and prepositions.</p> <p>To learn about sentence patterns in English.</p> <p>To learn the conversations of different situations in everyday life.</p> <p>To learn the concept of stress, stress shift in words and sentences.</p> <p>To study the words with silent letters and their pronunciations.</p> <p>To learn about the basic intonation patterns.</p>
6	SOA/HE 101 T	Introductory Economics	2+0	<p>The students will be able to understand Nature and scope of economics.</p> <p>The students will be able to state the concepts and divisions of economics, and also define economics.</p> <p>The students will be able to state the various theories related to consumer behavior such as equi-marginal utility, indifference curve, diminishing marginal utility.</p> <p>The students will be able to classify goods.</p> <p>The students will be able to state the characteristics of wants.</p> <p>The students will be able to define law of demand and understand the concept of price, income and cross elasticity's.</p> <p>The students will be able to explain consumer's surplus, Theory of firm and factors of production i.e. land, labour, capital and enterprise.</p> <p>The students will be able to describe theories of population.</p> <p>The students will be able to understand Cost concepts.</p> <p>The students will be able to state the Law of supply.</p> <p>The students will be able to explain the theories of rent, wage, interest and profit.</p> <p>The students will be able to understand the concepts of Price determination and forecasting under various market structures.</p>
7	SOA/HE 103 T	Introductory Biology	1+1	<p>To Introduction to the living world and classification of plant kingdom.</p> <p>To study about the binomial Nomenclature; characteristics of algae, fungi, bryophyte, pteridophyta; angiosperms and zymnosperm- structure and functions.</p> <p>To study about Morphology and important modification of root, stem and leaf, inflorescence, flower and fruit, seed structure and germination.</p> <p>To understand about cytology and histology (plant cell and tissues, internal structure of dicot and monocot plants).</p> <p>Introduction to the living world and classification of plant kingdom, binomial Nomenclature; characteristics of algae, fungi, bryophyte, pteridophyta; angiosperms and zymnosperms- structure and functions.</p> <p>Morphology and important modification of root, stem and leaf, inflorescence, flower</p>

S.No.	Course code	Course name	Credits	Course outcomes
				<p>and fruit, seed structure and germination; cytology and histology (plant cell and tissues, internal structure of dicot and monocot plants).</p> <p>To study the general classification of animal kingdom; characteristics of major groups of Non-chordata and chordate.</p> <p>To know the cell structure and function- cell as unit of life, prokaryotes, eukaryotes, cell organelles.</p> <p>To study the cell division- mitosis, meiosis; origin of life and an elementary knowledge of animal evolution; histology of gut, liver, kidney, ovary, testies and skeletal system of rabbit; physiology of digestion, respiration, circulation, excretion, coordination, endocrine and reproductive system.</p> <p>To understand the economic importance of animals in Forestry/Agriculture.</p>
8	SOA/HE 104 T	Sericulture	1+1	<p>Importance and history of sericulture, future scope.</p> <p>To study Mulberry cultivation geographical distribution, species and varieties, classification, climate, nursery and propagation, field preparation, planting methods, irrigation, manuring, pruning and training, insect pests and diseases and their management.</p> <p>Types of silk worms, morphology and life cycle.</p> <p>Rearing appliances and methods, maintenance of ericulture units, egg production techniques and post cocoon technology.</p> <p>Pests and diseases of silk moth, properties of silk, uses.</p> <p>Economics of sericulture. Recent trends in sericulture.</p> <p>Biology and behaviour of lac insect, host plants.</p> <p>The lac cultivation, manufacturing of shellac and its uses.</p>
2nd Semester				
1	SOA/HC 105 T	Introductory Microbiology	1+1	<p>To understand about history and Scope of Microbiology:</p> <p>To study about the discovery of micro-organism, spontaneous generation conflict, germ theory of diseases, microbial effect on organic and inorganic matter.</p> <p>To learn the Development of microbiology in India and composition of microbial world.</p> <p>To examine about Specimen Preparation and Microscopy:</p> <p>To study about The bright field microscope, fixation, dyes and simple staining, differential staining. Difference between prokaryotic and eucaryotic cells.</p> <p>To learn about the Prokaryotic cell structure and functions.</p> <p>To study about Types of culture media and pre-culture techniques.</p> <p>To study about Microbial growth in models of bacterial, yeast and mycelial growth</p>

S.No.	Course code	Course name	Credits	Course outcomes
				<p>curve and measurement of bacterial growth.</p> <p>To learn General properties of viruses and brief description of bacteriophages.</p> <p>To study about general principle of bacterial genetics, DNA as genetic material.</p> <p>To understand Antibiosis, symbiosis, intramicrobial and extramicrobial association.</p>
2	SOA/HC106 T	Principles of Genetics and Cytogenetics	2+1	<p>Historical background, theories and hypothesis of genetics discussed.</p> <p>Physical basis of heredity including cell reproduction, mitosis, meiosis and its significance explained.</p> <p>Mendel's principles of heredity, deviation from Mendelian inheritance workout with different crosses.</p> <p>Phenomenon of pleiotropy, co-dominance, penetrance and expressivity discussed.</p> <p>Chromosome theory of inheritance with gene interaction explained.</p> <p>Theories of multiple alleles, quantitative inheritance linkage and crossing over, sex linked inheritance discussed.</p> <p>Chemical basis of heredity, structure of DNA its replication and evidence to prove DNA and RNA –as genetic material described.</p> <p>Mutation and chromosomal aberrations discussed.</p>
3	SOA/HC 107 T	Apiculture (1)	1+1	<p>To understand about the morphology, anatomy, colony organization, behaviour, lifecycle, diseases and pests of honey bee.</p> <p>To gain knowledge about the apiculture techniques and recent trends of it.</p> <p>To understand the role of honey bee as pollinator and its role in increasing the productivity of horticultural crops in India economy</p>
4	HC108T	Medicinal and aromatic plants	2+1	<p>To know the different definitions of medicinal and aromatic plants</p> <p>To study the importance and scope of production of medicinal and aromatic Crops</p> <p>To know the cultivation practices and importance of pepper, cardamom, clove, ginger and turmeric,</p> <p>To know the cultivation practices and importance of betelvine, periwinkle, rauwolfia and dioscorea,</p> <p>To know the cultivation practices and importance of isabgol, ammi majus, belladonna, cinchona and pyrethrum</p> <p>To know the cultivation practices and importance of citronella grass, khus grass, sweet flag (bach), lavender and geranium</p> <p>To know the cultivation practices and importance of patchouli, bursera, mentha, muskdana (musk mallow), ocimum</p> <p>To study the endangered medicinal and aromatic plants of India and their conservation strategies</p>

S.No.	Course code	Course name	Credits	Course outcomes
				To know the chemical composition of a few important medicinal and aromatic plants, their extraction and use. To know the therapeutic and pharmaceutical uses of important species.
5	SOA/HC 109 T	Soil Fertility and Nutrient Management	1+1	Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, transformations and availability. To study about acid, calcareous and salt affected soils -characteristics and management. To know the role of microorganisms in organic matter- decomposition - humus formation. To know the importance of C:N ratio and pH in plant nutrition. Integrated plant nutrient management. To learn soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions, deficiency symptoms, visual diagnosis.
6	HA ECC102 T	Environmental science	1+1	To understand appropriate sociological and technological measures in environment management To focus on ecosystem services and human well being and livelihoods. To learn basis of problems and solutions in natural resource management To find solutions towards more sustainable societies around the globe To learn strategies for waste reduction and disposal To contribute meaningfully for analysis of environmental systems planning and management with both a local and global perspective To understand the concept of sustainable development To be able to cope with the impacts of climate change by adopting adaptation and mitigation measures To prepare the students for national and global employability
7	SOA/HE 105T	Fundamentals of Extension Education	1+1	To know Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry extension: process, principles and selected programmes of leading national and international forest institutes. People's participation in forestry programmes. To Motivate women community, children, youth and voluntary organizations for forestry extension work. To understand Rural Development: meaning, definition, objectives and genesis. To transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR.

S.No.	Course code	Course name	Credits	Course outcomes
				<p>Communication: meaning, definition, elements and selected models.</p> <p>Audio – visual aids: importance, classification and selection. Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods.</p> <p>To understand the Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA).</p> <p>Management and administration: meaning, definition, principles and functions.</p> <p>The Concepts of human resource development (HRD), rural leadership.</p>
8	SOA/HE 106 T	Fundamentals of Horticulture	1+1	<p>To study the Economic importance and classification of horticultural crops.</p> <p>To learn about the nutritive value of fruits and vegetables.</p> <p>To learn about the area and production of horticultural crops.</p> <p>To understand about the exports and imports of horticultural crops.</p> <p>To learn about fruit and vegetable zones of India and of different states</p> <p>To understand the nursery management practices, soil and climate.</p> <p>To gain knowledge about vegetable gardens, nutrition and kitchen garden and other types of gardens.</p> <p>To understand the principles, planning and layout.</p> <p>To learn about the management of orchards.</p> <p>To understand the planting systems and planting densities.</p> <p>To gain knowledge about production and practices for fruit, vegetables and floriculture crops.</p> <p>To gain knowledge about nursery techniques and their management.</p> <p>To understand the principles and methods of pruning and training of fruit crops.</p> <p>To learn about the types and use of growth regulators in horticulture.</p> <p>To learn about water management, weed management and fertility management in horticultural crops.</p> <p>To study about bearing habit and factors influencing fruitfulness and unfruitfulness.</p> <p>To learn about the rejuvenation of old orchards, top working, frame working</p> <p>To understand about the principles of organic farming.</p>
9	SOA/HE 107 T	Agrometeorology	1+1	<p>To study the definition, aim and scope of agrometeorology.</p> <p>To gain knowledge on the factors and elements of weather and climate.</p> <p>To study the composition and structure of atmosphere.</p> <p>To understand the air and soil temperature regimes.</p> <p>To learn about atmospheric humidity and types of clouds and precipitation, hails and frost.</p>

S.No.	Course code	Course name	Credits	Course outcomes
				<p>To understand the cyclones, anticyclones and thunderstorms.</p> <p>To learn about solar radiations, their components and effect on plant growth.</p> <p>To understand the effect of weather and climate on the growth and development of crops.</p> <p>To gain knowledge on climatic normals of crops.</p> <p>To understand the agroclimatic zones of India and Himachal Pradesh.</p> <p>To understand evaporation and transpiration.</p> <p>To learn the use of remote sensing techniques in agrometeorology.</p> <p>To learn agriculture weather forecasting.</p>
III Semester				
1	SOA/HC 110 T	Tropical and Sub-Tropical Fruits	2+1	<p>To know about Horticultural classification of fruits including genome classification.</p> <p>To learn about Horticultural zones of India.</p> <p>To understand about detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning.</p> <p>Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards.</p> <p>Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, bael, banana.</p> <p>To understand about detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops, grapes, citrus, papaya, sapota.</p> <p>To understand about detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. guava, pineapple, jackfruit, avocado, mangosteen.</p> <p>To understand about detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems,</p>

S.No.	Course code	Course name	Credits	Course outcomes
				<p>after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. litchi, carambola, durian and passion fruit.</p> <p>To understand the Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and casual factors and their management. Bud forecasting in grapes.</p> <p>To know about sex expression and seed production in papaya, latex extraction and crude papain production, economic of production.</p> <p>To understand about Rainfed horticulture, importance and scope of arid and semi-arid zones of India.</p> <p>To know about the Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.</p>
2	SOA/HC 111T	Weed Management in Horticultural Crops	1+1	<p>Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination</p> <p>To learn about Weed biology and ecology, crop weed association, crop weed competition and allelopathy</p> <p>To understand the Concepts of weed prevention, control and eradication;</p> <p>To know about Methods of weed control: physical, cultural, chemical and biological methods.</p> <p>Integrated weed management.</p> <p>To know about the Herbicides: advantages and limitation of herbicide usage in India. Herbicide classification, formulations, methods of application.</p> <p>Introduction of Adjuvants and their use in herbicides.</p> <p>Introduction of selectivity of herbicides; Compatibility of herbicides with other agro chemicals.</p> <p>To understand the Weed management in major field and horticultural crops, shift of weed flora in cropping systems.</p> <p>The concept of aquatic and problematic weeds and their control.</p>
3	SOA/HC 112 T:	Tropical and Sub-Tropical Vegetables	2+1	To study of Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of

S.No.	Course code	Course name	Credits	Course outcomes
				vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield and seed production. Economic of cultivation of tropical and sub-tropical vegetable crops; Post-harvest handling and storage. Marketing of tomato, brinjal, chillies, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca and basella.
4	SOA/HC 113T	Orchard Management	1+1	To learn about Orchard management, importance, objectives, merits and demerits. To understand the Clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches. To learn about Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems. To study about Biological efficiency of cropping systems in horticulture, systems of irrigation. The Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties. Integrated nutrient and pest management. To Utilization of resources constraints in existing systems. To have a Crop model and crop regulation in relation to cropping systems.
5	SOA/HC 114T	Principles of Plant Breeding	2+1	Introduction, limitations and major achievements in plant breeding discussed. Genetic basis of Plant Breeding explained. Sexual and asexual reproduction discussed. Pollination control mechanism viz., male sterility and self incompatibility described. Genetic components of polygenic variation explained. Hybrid development and concepts of heterosis explained.
6	SOA/HSEC 101 T	Plant Propagation and Nursery Management	1+1	To gain knowledge on plant Propagation and its Need, potentialities and types, sexual and asexual methods To study about sexual and asexual methods of plant Propagation and its advantages and disadvantages. To understand Seed dormancy and its types and internal and external factors To learn about nursery techniques, hardening of plants in nurseries, Nursery registration act, tools and implements and Insect/pest/disease control in nursery To study about mono embryony and polyembryony. To gain knowledge on Propagation structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds and poly-houses

S.No.	Course code	Course name	Credits	Course outcomes
				<p>To understand about growth regulators and its use in plant Propagation</p> <p>To gain knowledge on cutting, layering, grafting, budding and Micrografting</p> <p>To study about bio chemical basis of rooting, factors influencing rooting of cuttings and layering</p> <p>To learn about Anatomical studies of bud union, selection and maintenance of mother trees, graft incompatibility, collection of scion wood stick, scion-stock relationship, and their influences.</p> <p>To understand about techniques of propagation through specialized organs, corm, runners, suckers</p>
7	SOA/HE 109 T	Fundamentals of Entomology & Nematology	1+1	<p>Introduction to phylum arthropoda. Importance of class Insecta. Insect dominance. Definition, division and scope of entomology. Comparative account of external morphonology.</p> <p>ypes of mouth parts, antennae, legs, wings and genetallia.</p> <p>Anatomy of digestive, excretory, nervous and reproductive systems.</p> <p>Postembryonic developmenteclosion. Matamorphosis. Types of larvae and pupa.</p> <p>Classification of insects upto orders and families of economic importance and their distinguished characters.</p> <p>History of development of nematology- definition, economic importance.</p> <p>General characters of plant parasitic nematodes, their morphology. taxonomy and classification, biology, symptomatology and control of important plant parasitic nematodes of fruits- tropical, subtropical and temperate fruits, vegetables, tubers, ornamental and plantation crops.</p> <p>Role of nematodes in plant disease complex.</p>
8	SOA/HE 110 T	Introduction to major field Crops	1+1	<p>To study about the classification and distribution of major field crops (Cereals, Legumes, Oilseeds, Fodder Crops)</p> <p>To study about the Concept of Multiple Cropping,Mixed Cropping,Inter Cropping,Relay Cropping.</p> <p>To study about the Methods of Raising,Growing of Field crops.</p> <p>To study about Green Manuring</p> <p>To study about Crop Rotation</p> <p>To Identify weeds of Field Crops</p> <p>To study about the Methods of Fertilizer ,Herbicides and Insecticides Application in field Crops.</p>
9	SOA/HE 111 T	Fundamentals of Plant Pathology	1+1	<p>To understand about introduction to the science of phytopathology, its objectives, scope and historical background.</p>

S.No.	Course code	Course name	Credits	Course outcomes
				<p>To study about Classification of plant diseases, symptoms, signs, and related terminology.</p> <p>To learn the Parasitic causes of plant diseases (fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants), their characteristics and classification.</p> <p>To understand about non-parasitic causes of plant diseases.</p> <p>To study about infection process, Survival and dispersal of plant pathogens.</p> <p>To learn the Plant disease epidemiology, forecasting and disease assessment.</p> <p>To Understand about the Principles and methods of plant disease management and Integrated plant disease management.</p>
IV Semester				
1	SOA/HC 115 T	Spices and Condiments	1+1	<p>History, scope and importance, area and production, uses, export potential and role in national economy.</p> <p>Classification, soil and climate, propagation-seed, vegetative and micro propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products of Cardamom, pepper, ginger, turmeric and clove.</p> <p>Classification, soil and climate, propagation-seed, vegetative and micro propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products of nutmeg, cinnamon, all spice, curry leaf, coriander.</p> <p>Classification, soil and climate, propagation-seed, vegetative and micro propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products of fenugreek, fennel, cumin, dill, celery, bishops weed, saffron.</p> <p>Classification, soil and climate, propagation-seed, vegetative and micro propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products of vanilla, thyme and rosemary. methods of</p>

S.No.	Course code	Course name	Credits	Course outcomes
				extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper Export Promotion Council, institutions and research centers in R&D.
2	SOA/HC 116 T	Temperate Fruits	2+1	To gain knowledge on introduction and classification of temperate fruits. To study about areas, production, varieties, climate and soil requirements, propagation, planting density, cropping systems, after care training and pruning, self incompatibility and pollinisers, use of growth regulators, nutrient and weed management, harvesting, post-harvest handling and storage of apple, pear, peach, apricot, cherry, persimmon, strawberry, kiwi, Queens land nut (Mecademia nut), almond, walnut, pecan nut, hazel nut and chest nut. To understand about Re- plant problem and special production problems like pre-mature leaf fall, physiological disorders, important insect – pests and diseases and their control measures rejuvenation
3	SOA/HC117T	Ornamental Horticulture	2+1	Exposure to the history, scope of gardening, aesthetic values. To study about different gardens in India and various styles of garden. To acquaint with the term landscaping, its historical background, definition and basic principles and basic components. To gain the knowledge about floriculture industry and its importance, area and production, To get information about lawn making and various methods of designing rockery, water garden, vertical gardens, roof gardens, etc. To identify various ornamental plants like tree, climbers, shrubs, indoor plants, cactus, palm plants and different summer and winter annual flowering plants. To explore various propagation methods of shrubs and herbaceous perennials. To study the different kinds of flower arrangement and the cut flower crop with under subhead like importance, production details and cultural operations, constraints, post-harvest practices. To understand bio-aesthetic planning and its need in round country planning and in urban planning. To learn the various landscaping of schools, villages, railway stations, dam sites, hydroelectric stations, colonies, river banks, play grounds, parks and public gardens. To get introduced to bonsai and art of making bonsai.
4	SOA/HC 118 T	Water Management in	1+1	To study about mportance of water, water resources in India. Area of different crops under irrigation, function of water for plant growth. To study the effect of moisture

S.No.	Course code	Course name	Credits	Course outcomes
		Horticultural Crops		<p>stress on crop growth.</p> <p>To learn Available and unavailable soil moisture – distribution of soil moisture – water budgeting –rooting characteristics –moisture extraction pattern.</p> <p>To study water requirement of horticultural crops – lysimeter studies – Plant water potential climatological approach – use of pan evaporimeter.</p> <p>To learn about factor for crop growth stages – critical stages of crop growth for irrigation.</p> <p>To understand about irrigation scheduling – different approaches</p> <p>To study the methods of irrigation –surface and sub-surface pressurized methods viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water.</p> <p>To learn about water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops.</p> <p>To study about Layout of different irrigation systems, drip, sprinkler.</p> <p>Layout of underground pipeline system.</p>
5	SOA/HC 119T	Plantation Crops	2+1	<p>History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by products utilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of coconut, arecanut.</p> <p>History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by productsutilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of oil palm, palmyrah palm, cocoa.</p> <p>History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by</p>

S.No.	Course code	Course name	Credits	Course outcomes
				productsutilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of cshew nut, coffee, tea and rubber.
6	SOA/HSEC 102 T	Organic Farming	1+1	To study about Introduction, concept, relevance in present context. To understand Organic production requirements; Biological intensive nutrient management-organic manures vermicomposting, green manuring. To learn recycling of organic residues, biofertilizers; Soil improvement and amendments. To study about Integrated diseases and pest management use of biocontrol agents, biopesticides pheromones, trap crops, bird perches; Weed management. To understand about Quality considerations, certification, labeling and accreditation processors, marketing, exports.
7	SOA/HE 112 T	Breeding of Fruit and Plantation Crops	1+1	To gain knowledge on Fruit breeding, history, importance in fruit production To study about distribution, domestication and adaptation of commercially important fruits To learn about variability for economic traits, breeding strategies, clonal selection, bud mutations, mutagenesis. To understand about application in crop improvement, policy manipulations, <i>in vitro</i> breeding tools of important fruit and plantation crops.
8	SOA/HE113T	Growth and Development of Horticultural Crops	1+1	To study the growth and development, definitions, components, photosynthetic productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, growth analysis in horticultural crops. To study the Plant bioregulators- auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering-factors affecting flowering, physiology of flowering. To study about photoperiodism, long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning, source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy,

S.No.	Course code	Course name	Credits	Course outcomes
				causes and breaking methods in horticultural crops. To understand Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non climacteric fruits.
9	HE114T	Genetic Resources of Horticultural Crops	1+1	To understand the role of genetic resources- centres of origin and diversity of crops plants- law of homologous series To study about the plant introduction in horticultural crops and exchange of genetic resources To know the principles and concepts of plant quarantine To know the germplasm collection and centres- gene bank- gene sanctuary- need for conservation- genetic erosion- germplasm exploration- germplasm conservation- in vitro conservation cryopreservation To study the application of DNA finger printing in Horticulture. To know the wild relatives and sources of resistance to biotic, abiotic stresses and quality characters for fruit, vegetable, flower and plantation crops, spices and medicinal plants. To know the International institutes and organizations for germplasm To understand and know the trade Related Intellectual Property Rights (TRIPPS) and IPR for Indian cultivars.
V Semester				
1	SOA/HC 120 T	Temperate Vegetables	2+1	To gain knowledge on Importance of cool season vegetable crops in nutrition and national economy. To study about Area, production, export potential, description of varieties and hybrids, origin, climate and soil, production technologies, seed production, post-harvest technology, Diseases, insect pest, disorders and Marketing of cabbage, cauliflower, knol-khol, sprouting broccoli, Brussels' sprout, lettuce, palak, Chinese cabbage, spinach, garlic, onion, leek, radish, carrot, turnip, beet root, peas, broad beans, rhubarb, asparagus, globe artichoke.
2	SOA/HC 121 T	Principles of Landscape Gardening	1+1	To understand the Landscaping: historical background, basic principles and components. landscape composition of hills and plains. identification and use of landscape drafting equipments. drawing and designing of home gardens, public parks, avenues, farm complexes and institutions. Layout of formal garden, informal garden, terrace garden, rock garden, bog garden, sunken garden, designing of conservatory and lathe house. Landscape design for specific areas.

S.No.	Course code	Course name	Credits	Course outcomes
3	SOA/HC 122 T	Farm Power and Machinery	1+1	<p>To know the basic concepts of various forms of energy, unit and dimensions of force, energy and power, calculations with realistic examples. IC Engines: basic principles of operation of compression, ignition and spark ignition engines, two stroke and four stroke engines, cooling and lubrication system, power transmission system, broad understanding of performance and efficiency factors, power tillers and their types and uses. Electric motors: types, construction and performance comparison.</p> <p>To know Tillage: objectives, method of ploughing. Primary tillage implements: construction and function of indigenous ploughs, improved indigenous ploughs, mould board ploughs, disc and rotary ploughs. Secondary tillage implements: construction and function of tillers, harrows, levelers, ridgers and bund formers. Sowing and transplanting equipment: seed drills, potato planters, seedling transplanter. Grafting, pruning and training tools and equipment.</p> <p>To know the Inter-culture equipment: sweep. Junior hoe, weeders, long handle weeders.</p> <p>To know the Crop harvesting equipments: potato diggers, fruit pluckers, tapioca puller and hoists</p>
4	SOA/HC 123 T	Diseases of Fruits, Plantation and Medicinal and Aromatic Crops	2+1	<p>To study about Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of fruits crops <i>viz</i> mango, banana, grape, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, ber, apple, pear and peach, plum, almond, walnut, strawberry.</p> <p>To learn the Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of plantation crops <i>viz</i> areca nut, coconut, oil palm, coffee, tea, cocoa, cashew, rubber, betel vine.</p> <p>To understand about the Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of medicinal and aromatic crops <i>viz</i> senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, Solanum khasianum and Tephrosia.</p> <p>To study about the important post-harvest diseases of fruit, plantation and medicinal and aromatic crops and their management.</p>
5	SOA/HC 124 T	Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops	2+1	<p>General–economic classification of insects; ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops pest surveillance.</p> <p>Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub- tropical and temperate fruits, plantation, medicinal and aromatic crops like coconut, areca nut, oil palm, cashew, cacao, tea, coffee, cinchona, rubber, betel vine pest surveillance. Distribution, host range, bio-ecology,</p>

S.No.	Course code	Course name	Credits	Course outcomes
				<p>injury, integrated management of important insect pests affecting crops senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, Solanum khasianum and Tephrosia.</p> <p>Storage insects – distribution, host range, bioecology injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products.</p> <p>Toxicology – insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their tolerance limits.</p>
6	SOA/HSEC103T	Communication Skills and Entrepreneurship Development	1+1	<p>To understand about Entrepreneurship development and how to assess overall business environment in the Indian economy</p> <p>To have a brief overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs</p> <p>To learn about Globalisation and the emerging business / entrepreneurial environment</p> <p>To learn the Concepts of entrepreneurship, entrepreneurial and managerial characteristics</p> <p>To understand the management of an enterprise, motivation and entrepreneurship development, importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs</p> <p>To understand the SWOT analysis, generation, incubation and commercialization of ideas and innovations Government schemes and incentives for promotion of entrepreneurship</p> <p>Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures</p> <p>To learn about the Characteristics of Indian horticultural processing and export industry.</p> <p>To understand the Social Responsibility of a Business</p> <p>To study about Communication</p> <p>Skills: Structural and functional grammar</p> <p>To gain knowledge on meaning and process of communication, verbal and non-verbal communication listening and note taking, writing skills, oral presentation skills</p> <p>To maintain field diary and lab record</p> <p>To understand indexing, footnote and bibliographic procedures</p> <p>To have a brief knowledge of reading and comprehension of general and technical articles</p>

S.No.	Course code	Course name	Credits	Course outcomes
				To understand precise writing, summarizing, abstracting, individual and group presentations, impromptu presentation, public speaking, Group discussion To study about organizing seminars and conferences
7	SOA/HE 115 T	Soil and Plant Analysis	1+1	Methods of soil and plant sampling and processing for analysis. Quantification of minerals and their abundance. Soil structure and aggregate analysis. Theories and concepts of soil moisture estimation – gravimetric, tensiometric, gypsum block, neutron probe and pressure methods. Characterization of hydraulic mobility – diffusion and mass flow. Renewal of gases in soil and their abundance. Methods of estimation of oxygen diffusion rate and redox potential. Soil fertility evaluation methods. Use of radio tracer techniques in soil fertility evaluation. Soil micro-organisms and their importance. Saline, alkali, acid, waterlogged and sandy soils, their appraisal and management. Chemical and mineral composition of horticultural crops. Leaf analysis standards, index tissue, interpretation of leaf analysis values. Principles of working of pH meter, electrical conductivity meter, spectrophotometer, flame photometer and atomic absorption spectrophotometer. Quality of irrigation water.
8	SOA/HE 116 T:	Mushroom Culture	1+1	Introduction to mushroom fungi (Pleurotus, Volvariella and Agaricus) nutritional and medicinal value, edible and poisonous types mushroom Genetic improvement of mushroom Preparation of culture, mother spawn production, multiplication of spawn, cultivation techniques, harvesting, packing and storage Problems in cultivation diseases, pest and nematodes – weed moulds and their management strategies. Economics of cultivation Post harvest technologies.
9	SOA/HE117T	Fundamentals of Food Technology	1+1	To study about Food and its function, physico-chemical properties of foods and food preparation techniques To understand nutrition and its relation to good health. To learn about the Characteristics of well and malnourished population To gain knowledge on Energy and its definition, determination of energy requirements, food energy and total energy To study about Carbohydrates, their classification, properties, functions, sources and

S.No.	Course code	Course name	Credits	Course outcomes
				<p>their requirements</p> <p>To learn about the digestion, absorption and utilization of Proteins, their classification, properties, functions, sources, requirements, digestion, absorption, essential and non-essential amino acids, quality of proteins</p> <p>To learn PER/NPR/NPU, supplementary value of proteins and their deficiency</p> <p>To understand about Lipids – classification, properties, functions, sources, requirements, digestion, absorption and utilization, saturated and unsaturated fatty acids, deficiency, rancidity, refining of fats</p> <p>To learn about Mineral nutrition, macro and micro-minerals (Ca, Fe and P), functions, utilization, requirements, sources, effects of deficiency</p> <p>To have a knowledge on Vitamins, functions, sources, effects of deficiency, requirements of water soluble and fat-soluble vitamins</p> <p>To understand about Balanced diet, recommended dietary allowances for various age groups, assessment of nutritional status of the population</p>
VI Semester				
1	SOA/HC 125 T	Potato and Tuber Crops	1+1	<p>To study of origin, area, production economic importance and export potential of potato and tropical, subtropical and temperate tuber crops;</p> <p>To learn description of varieties and hybrids. Climate and soil requirements, season; seed rate; preparation of field; planting practices; spacing; water nutrient and weed management; nutrient deficiencies.</p> <p>To study about the use of chemicals and growth regulators; cropping systems.</p> <p>To learn about harvesting practices, yield; seed production, economics of cultivation. Post-harvest handling and storage, field and seed standards, marketing of the following Crops: potato, tapioca, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, jerusalem artichoke, horse radish and other under-exploited tuber crops.</p>
2	SOA/HC 126 T	Breeding of Vegetable Tuber and Spice Crops	2+1	<p>To know the centres of origin, plant bio-diversity and its conservation. Modes of reproduction, pollination systems and genetics of important vegetable, tuber and spice crops.</p> <p>To understand Selfincompatibility and male sterility, its classification and application in crop improvement.</p> <p>To study the principles of breeding self-pollinated crops, pure line selection, mass selection, heterosis breeding, hybridization, pedigree method, mass pedigree method,</p>

S.No.	Course code	Course name	Credits	Course outcomes
				<p>bulk method, modified bulk method, single seed descent method and back cross method.</p> <p>To study the Polyploidy breeding.</p> <p>To study the Mutation breeding. Principles of breeding cross pollinated crops, mass selection, recurrent selection, heterosis breeding, synthetics and composites.</p> <p>To know the Application of biotechnology in crop improvement of crops: Solanaceous vegetables, cole crops, cucurbits, bulb crops, root crops, leafy vegetables, okra, leguminous crops.</p>
3	SOA/HC 127T	Post-Harvest Management of Horticultural Crops	2+1	<p>To study the importance of post-harvest technology in horticultural crops</p> <p>To learn about maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, medicinal and aromatic plants</p> <p>To understand the Pre-harvest factors affecting quality and the factors responsible for deterioration of horticultural produce</p> <p>To learn the physiological and bio-chemical changes, hardening and delaying ripening process</p> <p>To gain knowledge on Post-harvest treatments of horticultural crops. Quality parameters and specification</p> <p>To write about the Structure of fruits, vegetables and cut flowers related to physiological changes after harvest</p> <p>To learn the various Methods of storage for local market and export.</p> <p>To gain knowledge on Pre-harvest treatment and precooling, pre-storage treatments</p> <p>Different systems of storage, packaging methods and types of packages, recent advances in packaging</p> <p>To learn the types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments</p> <p>To learn about the different Modes of transport in various horticultural crops</p>
4	SOA/HC 128 T	Seed Production of Vegetable, Tuber and Spice	2+1	<p>To study about seed and its history of seed industry in India</p> <p>To gain knowledge on Differences between grain and seed and importance and scope of vegetable seed production in India</p> <p>To learn about Principles of vegetable seed production.</p> <p>To understand about Role of temperature, humidity and light in vegetable seed production</p> <p>To study about Methods of seed production of cole crops, root vegetables, solanaceous vegetables, cucurbits, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables.</p>

S.No.	Course code	Course name	Credits	Course outcomes
				To gain knowledge on Seed germination and purity analysis, Field and seed standards To learn about Seed legislation, Seed drying and extraction.
5	SOA/HC 129 T	Insect Pests of Vegetable, Ornamental and Spice Crops	2+1	To be learn about the economic importance of insects in vegetable, ornamental and spice crops To be introduce the ecology and pest management with reference to these crops. Pest surveillance in important vegetable, ornamental and spice crops. To study the distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting vegetable, ornamental and spice crops. To introduce the basic concepts of Important storage insect-pests of vegetable, ornamental and spice crops, their host range, bioecology, injury and integrated management. To learn the insect –pests of processed vegetables and ornamental crops, their host range, bio-ecology, injury and integrated management. To Solve the insecticidal residue problems in vegetables and ornamental crops, tolerance limits etc.
6	SOA/HSEC 104 T	Commercial Floriculture	1+1	To study about the scope and importance of commercial floriculture in India, To learn various production techniques of ornamental plants like rose, marigold, chrysanthemum, orchid, carnation, gladiolus, jasmine, dahlia, tuberose, bird of paradise, china aster and gerbera for domestic and export market. To get the knowledge of growing of flowers under protected environments such as glass house, plastic house etc., To get acquaint with the knowledge of post harvest technology of cut flowers in respect of commercial flower crops, dehydration technique for drying of flowers, To learn production techniques for bulbous plants
7	SOA/HE 118T	Breeding and Seed Production of Ornamental Plants	1+1	History and objectives of ornamental plant breeding discussed. Crop improvement methods like introduction, selection, hybridization, mutation and biotechnological technique explained. Breeding strategies for disease resistance described. Development of promising cultivars of important ornamentals. Role of heterosis and its exploitation explained. Hybrid seed production using male sterility elaborated. Production of open pollinated varieties and concept of seed certification described.
8	SOA/HE 119 T	Diseases of Vegetable, Ornamental and	1+1	To study about Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following vegetable crops: tomato, brinjal, chilli, bhindi, cabbage, cauliflower, radish, knol-khol, pea, beans, potato, beet root and onion.

S.No.	Course code	Course name	Credits	Course outcomes
		Spice Crops		To study about Etiology, symptoms, mode of spread epidemiology and integrated management of diseases of the following spice crops: fenugreek, ginger, garlic, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, cinnamon. To learn about Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following ornamental crops jasmine, rose, crossandra, tuberose, geranium. To understand Important post-harvest diseases of vegetables and ornamental crops and their management.
9	SOA/HE 120 T	Protected Horticulture	1+1	Importance and scope, basic principles of protected cultivation. Green and polyhouse designs. green house environment control, heating and cooling system- use of portable tunnel. Green house cultivation of important horticultural crops- rose, carnation, gerbera, orchids, anthurium, tomato, bell, pepper and strawberry. Insect pest and disease management under protected cultivation.
VII Semester				
1	SOA/HC 130 T	Processing of Horticultural Crops	2+1	To gain knowledge on Importance and scope of fruit and vegetable preservation industry in India To study about food pipe line, losses in post-harvest operations, unit operations in food processing. To learn about Principles and guidelines for the location of processing units To understand about Principles and methods of preservation by heat pasteurization, canning, bottling To gain knowledge on Methods of preparation of Jam, jelly and marmalade Pickling, chutneys juices, tomato products, mushrooms products squashes, syrups, cordials and fermented beverages. To learn about Processing of plantation crops, products, spoilage in processed foods, quality control of processed products To study about Govt. policy on import and export of processed fruits. Food laws.
2	SOA/HC 131 T	Protected Cultivation of Horticultural Crops 1.Project Preparation 1.Project	3+3	Visit to commercial polyhouses, Project preparation and planning. Specialised lectures by commercial export house.

S.No.	Course code	Course name	Credits	Course outcomes
		Preparation		
3	SOA/HC 132 T	Nursery Production and Management	3+3	Project preparation
4	SOA/HSEC 105 T	Horti- Business Management	2+0	<p>To study farm management definition, nature, characteristics and scope.</p> <p>To learn Farm management principles and decision making, production function, technical relationships, cost concepts, curves and functions – factors, product, relationship – factors relationship, product relationship, optimum conditions, principles of opportunity cost-equi-marginal returns and comparative advantages,</p> <p>To understand time value of money, economic of scale, returns to scale,</p> <p>To learn cost of cultivation and production, break even analysis, decision making under risk and uncertainty.</p> <p>To understand Farming systems and types. Planning – meaning, steps and methods of planning, types of plan, characteristics of effective plans.</p> <p>To learn Organizations – forms of business organizations, organizational principles, division of labour.</p> <p>To understand Unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability.</p> <p>To learn direction – guiding, leading, motivating, supervising, coordination meaning, types and methods of controlling – evaluation, control systems and devices.</p> <p>To understand budgeting as a tool for planning and control. Record keeping as a tool of control.</p> <p>To understand Functional areas of management – operations management – physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality.</p> <p>To understand the materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ).</p> <p>To understand Personnel management – recruitment, selection and training, job specialization.</p> <p>To learn Marketing management – definitions, planning the marketing programmes, marketing mix and four P' s. Financial management – financial statements and ratios, capital budgeting.</p> <p>To prepare project and its evaluation measures.</p>

S.No.	Course code	Course name	Credits	Course outcomes
VIII Semester				
1	SOA/HC 132T	Horticultural Work Experience 1.	6	The students will spend one full semester working with State Department of Horticulture; Horticulture based industries, commercial horticulture farms, plantation industries etc. to gain first hand information and hands-on-training in the chosen area of interest Project Preparation
2	SOA/HC 133P	Horticultural Work Experience II.	6	Field Work
3	SOA/HC 134 T	Horticultural Work Experience III.	6	Report writing, Presentation and Discussion

B.Sc. Medical Lab Technology

Programme Summary

Duration: 3 years + 6 months internship

Eligibility

10+2 with at least 45% marks in PCB/PCM or DMLT from any state technical board or university.

Program outcomes:

- Perform routine clinical laboratory procedures within acceptable quality control parameters in Hematology, Biochemistry, Microbiology, Serology, Histopathology, Blood banking, Urinalysis and other body fluids under the supervision of Pathologist or technologist.
- Learn proper care and safe use of basic laboratory glassware and equipment including the cell counter, microscope, centrifuge, incubator, colorimeter, analytical balance, microtome .
- Learn the role of the phlebotomist and display professional behavior in dealing with patients, their family, and public.
- Appropriately and successfully collection of blood specimens through venipuncture and capillary puncture .
- Learn to maintain quality control system in pathology lab in order to improve efficiency and accuracy of various investigations.
- Learn about the morphological variations of various blood cells and discuss their clinical importance.
- Learn normal ranges/values for all common hematology /Biochemical parameters and their clinical significance.
- Discuss theory and principles of haemostasis including synthesis of various extrinsic and intrinsic coagulation factors of plasma and platelet function.
- Learn primary aspects of the blood bank including ABO-Rh and other common blood group systems, their antigens and antibodies compliment, agglutination, antiglobulin, antibody identification, transfusion therapy, transfusion reactions, and hemolytic disease of the newborn.
- Learn immunology and serology basics such as antigens, antibodies, compliments, Antigen-antibody reaction, immunity , inflammation, vaccines etc.
- Learn various gram positive and gram negative bacteria, viruses and fungi causing diseases to human beings.
- Learn various microbial diseases and their methods of lab investigations. Discuss principles, rationale use and interpretation of culture media to isolate and identify different microbes found in blood, urine or other body fluid cultures. Demonstrate proficient use of routine media.
- Explain and perform all phases of the Gram stain including smear preparation, stain, evaluation, reading, reporting and interpretation.

- Describe principle, rationale uses and interpretation of routine biochemical tests for organism identification. Demonstrate proficient use of routine biochemical tests.
- Identify basic guidelines for safe use of chemicals including proper labeling, protective measures, location and use of SDS, and disposal of hazardous chemicals.
- Discuss the principle and limitations of each dipstick test for chemical analysis of the urine.
- Operate and maintain laboratory equipment, utilizing appropriate quality control and safety procedures.
- Study routine tissue processing and freeze drying technique in histopathology. Study of various staining techniques to identify premalignant or malignant condition.
- Study of various aspiration techniques such as FNAC.

Course outcomes:

S.No	Course code	Course name	Maximum Marks (theory+Lab)	Course Outcomes
1	BMLT 101	Human Anatomy & Physiology	70+30	<p>The prime concern of this subject is to learn the terminology of the subject and basic knowledge of cells & tissues and to understand anatomy of human body.</p> <p>After successful completion of this course students are expected to be able to understanding the structure and function of organs and organ systems in normal human body. Discuss the physiology of the nervous, musculoskeletal, respiratory, and cardiovascular systems from a regional perspective.</p> <p>Analyze and describe the structures and functions of human anatomy and physiology from a regional perspective for the following regions: head and neck, thoracic, abdomino-pelvic, and upper and lower extremities.</p> <p>Compare and contrast the major bones and their processes as they relate to each region of the body. Describe briefly the basic components and functions of the digestive, urinary, and endocrine systems.</p>
2	BMLT 102	Basic Pathology	70+30	<p>The syllabus of pathology aims at preparing the students in basic understanding of diseases and their pathogenesis.</p> <p>Introduction to Hematology. Laboratory organization and safety measures.</p> <p>Study of Formation, composition and functions of blood. Learn to anticoagulants, mode of action of anticoagulants and their merits and demerits. Demonstrate Collection, preservation, transport and handling and disposal of blood samples.</p> <p>To learn Basic hematology and estimation of haematocrit values, physiological variations, normal and absolute values, and quality assurance in hematology.</p> <p>Pathology of inflammation in response to microbial invasion. Pathology of specific chronic infective disorders : Tuberculosis, Leprosy, Syphilis, and rheumatological disorders.</p> <p>Introduction to blood banking technology.</p>
3	BMLT 103	Clinical Biochemistry	70+30	<p>This syllabus has been formulated to impart basics knowledge of biochemistry, apparatus, units, equipment, and volumetric analysis in the Clinical Biochemistry.</p> <p>Students will be able to demonstrate an understanding of fundamental biochemical principles, such as the structure/function of bio-molecules</p> <p>To Learn introduction to Clinical Biochemistry and role of medical microbiologist, ethics, responsibility, safety measure and hazards in clinical biochemistry lab and first aid in laboratory accidents.</p> <p>Unit of measurements and calibration of volumetric apparatus. Colorimetry, spectrophotometry, flame-</p>

				<p>photometry, analytical balance etc. (principles, instrumentations and applications).</p> <p>To the study the Structure, Classification and function of carbohydrates, lipid, proteins, nucleic acid and enzymes in biological system.</p> <p>Qualitative tests for glycosuria, pentosuria, galactosuria, proteinuria, microalbuminuria and Bence Jones Proteinuria and their clinical significance. Qualitative test of urine for uric acid, urea and creatinine. Quantitative estimation of 24 hrs urine for albumin and 17-ketosteroids and their clinical significance.</p>
4	BMLT104	Preventive Medicine and Health Care	70+30	<p>After completion of this syllabus students are able to tailor their education plan to meet their own interests in Preventive Medicine. This may include content areas such as occupational medicine, addiction medicine, or infectious diseases.</p> <p>To learn water, air and noise pollution: Removal of water hardness, purification of water and standards of water quality.</p> <p>To understand the concepts of Hygiene and sanitation: Sanitation barriers, excreta disposal and disposal of hospital waste. Incineration and disinfection.</p> <p>To study Infections and control: Microbial pathogenicity, source and spread of infections in community.</p> <p>To demonstrate the prophylactic immunization: rationale of immunization, immune response and duration of immunity. Various national immunization programs and vaccine schedules.</p> <p>To understand the concepts of Reproductive, Family planning and Child Health Care Programs.</p> <p>To learn bacteriology examination of water, milk, food and air.</p> <p>To study of health care by balance diet and yoga. Normal constituents of diet, various diet programs, balance diet. Health Planning and Management.</p>
5	BMLT 105	Microbial Biology	70+30	<p>After successful completion of this course students are expected to be able to: Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.</p> <p>Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea.</p> <p>This subject gives a general insight into the history, basics of microbiology and imparts knowledge about equipment used in microbiology. Discovery of micro-organisms. Contribution of Robert Koch, Antony Van Leeuwen Hock, Louis Pasteur, Bordot, Paul Ehrlich, Alexander Fleming, Matchnikoff, Needham, Tyndall Jenson, Joseph Lister, Kal Land Steiner etc.</p> <p>To study of Morphology and Nature of bacteria, Classification and identification of bacteria, Sterilization and disinfection.</p>

				<p>To learn Cultural Medias, Cultivation of bacteria and Growth and Nutrition of Bacteria.</p> <p>To demonstrate the lab. Organization, Management, Recording of Results and Quality Control in Medical Microbiology.</p>
6	BMLT 106	Technical Methods in Microbial Biology	70+30	<p>This course make the students to know handling of instruments and sterilization techniques</p> <p>To demonstrate the safety measures in Microbiology Laboratory : Occurrence of lab infections, route of infections in laboratory, safety measures precaution in use of pathogens in teaching. Lab organization, management, recording of results and quality control in Medical Microbiology Lab.</p> <p>To study of various types of Microbiological Instruments such as microscope, pH meter Autoclave, Incubator, Hot air oven, Laminar Air Flow, Colony Counter, Muffle Furnace, Refrigerator, Inoculator, Mac-intos Field-jar etc.</p> <p>To learn Instruments used in immunology : Electrophoresis, Immunodiffusion, starplate, chromatography, ELISA reader, automatic washer and RIA equipments etc.</p> <p>To understand the concepts of Preparation of stains used in microbiology lab.</p> <p>To learn care and management of experimental animals.</p> <p>To learn Culture and Drug Sensitivity tests.</p>
7	Practical Paper I	Laboratory course -I	70+30	To impart practical knowledge based on theory papers BMLT 101 / BMLT 102.
8	Practical Paper II	Laboratory course - II	70+30	To impart practical knowledge based on theory papers BMLT 103 / BMLT 104.
9	Practical Paper III	Laboratory course - III	70+30	To impart practical knowledge based on theory papers BMLT 105 / BMLT 106.
2nd year				
1	BMLT 201	Clinical Biochemistry – I [Separative and Instrumental Techniques]	70+30	<p>The syllabus has been formulated to impart basics knowledge of biochemistry, apparatus, units, equipment, and volumetric analysis in the Clinical Biochemistry.</p> <p>To learn thin layer Chromatography, gas liquid Chromatography, Colorimetry, flame photometry, Atomic absorption spectroscopy etc</p> <p>To learn the Paper and gel electrophoresis for hemoglobin, urinary proteins, serum, CSF & LDH.</p> <p>To understand the concepts of Immunochemical, Immunoprecipitation, Immunofixation and radial immunodiffusion tests, ELISA,RIA, Polymerase chain reaction (PCR), Osmometry, Semi autoanalyzer.</p> <p>Students will use current biochemical and molecular techniques to plan and carry out experiments. They will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data.</p>

2	BMLT 202	Clinical Biochemistry – II [Metabolic and Blood Chemistries]	70+30	<p>This syllabus has been formulated to impart basics knowledge of Carbohydrate metabolism, lipid metabolism, protein metabolism.</p> <p>To learn the Principle, assay procedures and clinical significance of Glucose, Proteins, A/G, urea, BUN, uric acid, creatinin cholesterol, Bilirubin (Direct and Indirect).</p> <p>To learn about the electrolytes, Quantitative estimation of sodium, potassium, calcium, chloride, lithium, phosphorus, magnesium and their clinical significance.</p> <p>To the study of Acid base balance test, Xylose Absorption test and insulin tolerance test, Urea and creatinin clearance tests, Renal function tests, Glycosylated Hb & Liver function tests.</p> <p>Students will be able to demonstrate an understanding of fundamental biochemical principles, such as the structure/function of bio-molecules, metabolic pathways, and the regulation of biological and biochemical processes.</p>
3	BMLT 203	Medical Microbiology - I [Bacterial Pathogens & Associated Diseases]	70+30	<p>After successful completion of this course students are expected to be able to:</p> <p>Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.</p> <p>Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea.</p> <p>Understand the normal microflora of human body, Skin, Respiratory System, Gastrointestinal and Genitourinary tracts. Source of infection, mode of spread and portals of entry.</p> <p>Understand the pathogenecity, mode of infection, incubation period and toxigenecity of <i>Staphylococcus</i>, <i>Streptococcus</i>, <i>Pneumococcus</i>, <i>Neisseria</i>, <i>Bordetella</i>, <i>Haemophilus</i>, <i>Salmonella</i>, <i>Shigella</i>, <i>Proteus</i>, <i>Pseudomonas</i>, <i>Loefflerella</i>, <i>Vibrio</i>, <i>Escherichia coli</i> <i>Clostridia</i>, <i>Corynbacteria</i>, <i>Erysipelothrix</i>, <i>Listeria</i>, <i>Mycobacteria</i>, <i>Brucella</i>, <i>Yersenia</i>, <i>Pasteurella</i> & <i>Francisella</i>.</p> <p>To learn host Parasite interaction in bacterial infections. Pathogenic properties of bacteria (colonization of surfaces, invasion of tissue, production of exo and indo toxins). Anti bacterial defense of the host.</p> <p>Understand the concepts of Physiology and Biochemistry of Bacteria : Protein, Carbohydrate, lipids and nucleic acid as antigens.</p>
4	BMLT 204	Medical Microbiology-II [Technical Methods in Medical	70+30	<p>After successful completion of this course students are expected to be able to: Know various Culture media and their applications and also understand various physical and chemical means of sterilization</p> <p>Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and</p>

		Microbiology]		<p>algae</p> <p>Learn the role of laboratory in the diagnosis and control of infections. Management and quality control of medical microbiology laboratory.</p> <p>Learn the specimen collection from patients, clinics and hospitals and Specimen collection for epidemiological investigations.</p> <p>Learn the Morphology, Staining, Cultural Character of Bacteria. Selective cultural medias, indentification by special tests, biochemical reactions and sero-typing, pathogenesis of Gram's postivie cocci (Cluster forming, chain forming and diplo cocci), Neisseria, Bordetella , Haemophilus, Corynebacterium, Mycobacterium, Atypical Mycobacterium, Anthrax bacillus, Brucella, Yersenia, Pasteurella etc.</p> <p>To understand the concepts of Microbial drugs sensitivity test's and its clinical interpretation.</p>
5	BMLT 205	Pathology & Allied Subjects-I (Hematology)	70+30	<p>After completion of this course students will acquire and demonstrate competency in laboratory safety and in routine and specialized pathology laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.</p> <p>To learn Coagulation and its mechanism of coagulation, coagulation regulation, hypercoaguable states, different types of bleeding disorders, role of platelets in haemostasis.</p> <p>To the study of various types of anaemia and its etiological causes, lab diagnosis and changes in the blood morphology due to anaemia.</p> <p>Discussion on Leucocytosis, neutropenia and pancytopenia their causes.</p> <p>To the study of hematological malignancies: such as Leukemia, Lymphomas, Multiple myeloma and their identification and clinical features and lab investigation.</p> <p>To learn the Various Parasites in blood and their clinical significance. Lab investigations and methods of identification.</p>
6	BMLT 206	Pathology and Allied Subjects – II (Histotechnology)	70+30	<p>At the end of the course the students should be able to :</p> <ul style="list-style-type: none"> • Diagnose routine and complex clinical problems on the basis of Histopathology (Surgical Pathology) and Cytopathology specimens, Blood and Bone Marrow examination and various tests under the domain of Laboratory Medicine (Clinical Pathology, Clinical Biochemistry/Chemical Pathology) as well as Blood Banking (Transfusion Medicine). • Interpret clinical and laboratory data with reasonable accuracy.To demonstrate the Reception recording

				<p>and labeling of histology specimens in the histopathology lab.</p> <p>To learn the various histological techniques used in histopathology lab and during the tissue processing such as Fixation, fixatives, embedding, Decalcification, Microtomy, mounting etc</p> <p>To learn the dye chemistry theory, routine staining procedures H and E, Special staining procedures for connective tissues carbohydrates, amyloids and pigments. Meta chromasia and meta chromatic dyes.</p> <p>To understand the concepts of Museum techniques and faults & remedies during the section cutting.</p>
7	Practical Paper I	Laboratory course -I	70+30	To impart practical knowledge based on theory papers BMLT 201 / BMLT 202
8	Practical Paper II	Laboratory course - II	70+30	To impart practical knowledge based on theory papers BMLT 203 / BMLT 204.
9	Practical Paper III	Laboratory course - III	70+30	To impart practical knowledge based on theory papers BMLT 205 / BMLT 206.
3rd Year				
1	BMLT 301	Clinical Biochemistry – 1 (Biostatistics, Automation & Endocrinology)	70+30	<p>This syllabus has been formulated to impart basics knowledge bio-static for clinical quality control. Standard deviation, standard error, coefficient of variation, normal distribution, t-test and chi-square test.</p> <p>Students will use current biochemical and molecular techniques to plan and carry out experiments. They will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data</p> <p>To understand the concepts of establishment and maintenance of quality control for laboratory tests based upon medical usefulness.</p> <p>To discuss normal ranges of various bio-metabolites and their confidence limits.</p> <p>To demonstrate the Automation, Handling of automatic analyzers, management of hospital laboratory.</p> <p>To learn the Toxicology with screening & drug interference with laboratory findings and Endocrinology & their clinical interpretation.</p>

2	BMLT 302	Clinical Biochemistry – II (Diagnostic Enzymology)	70+30	<p>After completion of this course student is able to understand the basics about enzymes, enzyme activity determination, units for expressing enzyme activity, factors affecting enzyme activity and mechanisms responsible for abnormal enzyme levels.</p> <p>To learn isoenzymes such as serum CPK, CK – MB, LDH, SGOT (AST), SGPT (ALT), Cholinesterase HBDH, amylase, alpha amylase, lipase, aldolase and myoglobin.</p> <p>Learn about Serum leucine, amino peptidase, alkaline, acid phosphatases, fructosamine test in semen.</p> <p>Learn the Gastric analysis, pentagastrin test, histamine & caffeine stimulation tests, thyroid function test and infertility profile.</p>
3	BMLT 303	Medical microbiology – i (Pathogenic Viruses and Misc. Microbes)	70+30	<p>After successful completion of this course students are expected to be able to learn the microbes such as Actinomyces, Nocardia, Donovanias, Treponema, Chlamydia, Rickettsiae, Mycoplasma and its pathogenesis and lab diagnosis.</p> <p>To understand the concepts of Pox – viruses, Herpesviruses, Adenoviruses, Orthomyxoviruses, Paramyxovirus, Miscellaneous Viruses, Picorna Viruses.</p> <p>To learn the Hepatitis, Encephalitis Yellow fever, Dengue fever, Rabies.</p> <p>To demonstrate the cell culture and observation of effect of viruses on cell and its technique, procedure and interpretation of results.</p>
4	BMLT 304	MEDICAL MICROBIOLOGY – II [Technical Methods in Medical Microbiology]	70+30	<p>This syllabus has been formulated to impart basic knowledge about preparation of container and swabs for collections of specimens for microbial examinations, transport of specimen, and documentation of specimen in laboratory. Flowchart of lab diagnostic procedures.</p> <p>At last students will use current biochemical and molecular techniques to plan and carry out experiments.</p> <p>To demonstrate the preservation of Micro-organisms, periodic subculture method, cold storage, freezing, deep freezing, lyophilization methods. Total and viable counts of bacteria.</p> <p>Learn the concepts of Immunology, sero-diagnosis and advanced diagnostic techniques of torch profile, myco, dot, IgG, IgA, IgM and IgE testing, Australia Ag (HBs) etc.</p> <p>To learn test for bacterial sensitivity to antimicrobial agents and their interpretation.</p>

5	BMLT 305	PATHOLOGY & ALLIED SUBJECTS-I (<i>IMMUNOPATHOLOGY & TRANSFUSION MEDICINE</i>)	70+30	<p>After completion of this course students will acquire and demonstrate competency in laboratory safety and in routine and specialized pathology laboratory skills.</p> <p>To learn the immunity, antigens, antibodies & Immunoglobulin, cells and organs of the immune system, Humoral & Cellular immune response.</p> <p>To understand the concepts of detection of various allergic agents and immunopathology of allergy.</p> <p>To learn Pathogenesis and Lab diagnosis of Rheumatological diseases, inflammation megaloblastic anaemias, iron deficiency, haemolytic anemia and leukemia</p> <p>To understand the concepts of detection of Cancer immunology & Tumor markers.</p> <p>To demonstrate the tissue typing for kidney transplant & bone marrow transplant.</p> <p>To demonstrate the Laboratory investigations in coagulation disorder, bleeding disorder and Platelet functions tests.</p> <p>To learn the cytogenetics in hematology and Radioisotopes and their applications.</p>
6	BMLT 306	PATHOLOGY AND ALLIED SUBJECTS - II (<i>HISTOPATHOLOGY & CYTOLOGY</i>)	70+30	<p>To study the types of tissue seen in histopathology i.e Connective tissue, Epithelial tissue, Glandular tissue, Benign/ Malignant tumor tissue, Bone tissue etc.</p> <p>To study the handling of fresh histological specimen.</p> <p>To learn about freeze drying and cryostat.</p> <p>To study about identification and demonstration of lipids.</p> <p>To learn about various staining techniques for identification and demonstration of microorganisms in tissue.</p> <p>To study about various enzymes demonstration in tissues such as phosphatases, dehydrogenase, oxidase and peroxidases, etc.</p> <p>To learn about Electron Microscopy and Ultra microtomy.</p> <p>To learn about Aspiration Cytology like FNAC for premalignant lesions.</p> <p>To learn about hormonal assessment by cytological techniques.</p>
7	Practical Paper I	Laboratory course -I	70+30	To impart practical knowledge based on theory papers BMLT 301 / BMLT 302.
8	Practical Paper II	Laboratory course - II	70+30	To impart practical knowledge based on theory papers BMLT 303 / BMLT 304.
9	Practical Paper III	Laboratory course - III	70+30	To impart practical knowledge based on theory papers BMLT 305 / BMLT 306.

B.Sc. Medical Microbiology

Programme Summary

Duration: 3 years

Eligibility

10+2 in Science stream

Programme outcome:

- To provide comprehensive knowledge of structure, function and pathological changes of the organs and the clinical correlation of diseases and its pathology .
- To study the Clinical Biochemistry and role of medical microbiologist, ethics, responsibility, safety measure and hazards in clinical biochemistry lab. First aid in laboratory accidents. To understand fundamentals of biochemistry including carbohydrates, lipids, proteins nucleotides, enzymes.
- To provide knowledge of epidemiology, surveillance and control of infections (community & hospital).
- To understand the basic microbial structure and function and characteristics of prokaryotes and eukaryotes .
- To introduce various culture media and their applications.
- To skill the microbial techniques for isolation of pure cultures of bacteria and fungi and to understand concept of sterilization.
- Introduction to principle and application of fundamental laboratory equipments related to microbiological techniques.
- To learn the basic principles of medical microbiology and infectious diseases including mechanism of disease transmission, principles of aseptic practices, and the role of normal micro flora.
- To teach laboratory diagnosis of infectious diseases (cultural, biochemical and sero diagnosis).
- To acquire knowledge of Immune reactions and laboratory tests for detection of antigen and antibodies and its clinical significance.
- To analyze the biological data using bioinformatics tools.

Course outcome:

S. No.	Course Code	Course name	Max marks	Course outcome
1st Year				
1.	BMM-101	Human Anatomy & Physiology	70+30	To learn the Organization of human body and integrated physiology. To impart the knowledge of gross anatomy and histology of organs of respiratory system, digestive system, reproductive system and cardiovascular system. To gain knowledge of anatomy and histology of musculo-skeletal system, classification and functions of bones and muscles. To learn about the mechanism of hormone production, factors controlling it and their mechanism of action.
2.	BMM-102	Basic Pathology	70	To gain the knowledge of Collection, preservation, transport and handling and disposal of blood samples. To understand the various pathological processes and their importance in human disease. Build a basic understanding of Various routes of transport of Microbes to human body and methods of defense. Invasive techniques for diagnosis of acute and chronic microbial infections. Evaluate the ways in which pathology contributes to the understanding of patient presentation in a clinical setting. Introduction to blood banking technology.
3.	BMM-103	Clinical Biochemistry	70	Basic awareness of clinical biochemistry laboratory in respect to equipments and glassware. To study the preparation of standard solutions, buffer solutions and pH determination. To learn the biochemical composition of body fluids and their physiological variations. To gain the knowledge of qualitative tests for glycosuria, pentosuria, galactosuria, proteinuria, microalbuminuria and Bence Jones Proteinuria and their clinical significance. Acquire the knowledge of Classification, nomenclature, structure, general properties and functions of Carbohydrates, Lipids, Proteins, Nucleic acid and Enzymes.
4.	BMM-104	Preventive Medicine & Health Care	70	Role of laboratory in community and hospital infections. Management of patients in infectious diseases hospital (IDH). Awareness of Various national immunization programs and vaccine schedules. Reproductive, Family Planning & Child Health Care Programs. To learn the Bacteriology of water, milk, food and air. Awareness of normal constituents of diet, various diet programs, balance diet and factors responsible for etiology of various nutritional disorders. Role of regular exercise & yoga in prevention and management of various diseases.
5.	BMM-105	Fundamentals of Medical Microbiology	70	To gain Knowledge of the historical background of Microbiology. To understand the Role of medical microbiology in identification and management of various infectious diseases. To Acquire the knowledge of microbial cell structure, classification, growth and metabolism. To appreciate the scope and relevance of medical microbiology.

				<p>To understand the Collection, transport processing & storage of clinical samples for microbiological analysis.</p> <p>To learn Introduction of bacteriology, virology, mycology and parasitology.</p> <p>To gain knowledge and develop skills of general microbiological techniques (isolation, cultivation and preservation methods).</p> <p>To learn about Disinfectants, antiseptics, chemotherapeutic agents, future development of chemotherapy, antibiotics and effect of antibiotics on protein, nucleic acid and cytoplasmic membrane.</p>
6.	BMM-106	Instrumentation Techniques in Medical Microbiology	70	<p>To learn in detail about Principles and applications of Microscopy.</p> <p>To be skilled on the basic instruments used in microbiology and immunology.</p> <p>To learn about the basic staining techniques used in microbiology .</p> <p>To gain knowledge and develop skills of Care and management of experimental animals This helps to understand the use of lab animals in medical field.</p> <p>To document the results of Culture, isolation and identification of pathogens from urine, pus and sputum.</p>
		03 Practicals (Course 1&2=1; 3&4=1; 5&6=1)		<p>To impart practical knowledge and hands on training based on courses BMM-101 and BMM-102</p> <p>To impart practical knowledge and hands on training based on courses BMM-103 and BMM-104</p> <p>To impart practical knowledge and hands on training based on courses BMM-105 and BMM-106</p>
2nd Year				
6.	BMM-201	Bacterial Pathogens & Associated Diseases	70	<p>To learn infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.</p> <p>To provide knowledge regarding mechanism of pathogenesis.</p> <p>To learn in detail account of pathogenecity, mode of infection, incubation period and toxigenecity of various grams positive and gram negative bacteria.</p> <p>To gain knowledge of antigenic properties of Protein, carbohydrate, lipids and nucleic acid .</p>
7.	BMM-202	Systematic Bacteriology	70	<p>To learn the management and quality control of medical microbiology laboratory.</p> <p>To provide knowledge regarding Specimen collection from patients, clinics and hospitals for epidemiological investigations.</p> <p>Training of medical microbiologist to handle epidemics.</p> <p>To learn in detail account of morphology, staining, cultural character of bacteria.</p> <p>To learn selective cultural media, identification by special tests, biochemical reactions and stereotyping of various gram-positive and gram-negative bacteria.</p> <p>To learn the microbial drugs sensitivity test and its clinical interpretation.</p>
8.	BMM-203	Misc. Microbes, Fungal Pathogens & Ass. Diseases	70	<p>To understand the Principle and mode of action of antibiotics, antifungal and antiviral agents.</p> <p>To study the detail accounts of description, pathogenecity, mode of infection, incubation period and toxiegenecity of Bacteroides, Streptobacilli, Donovanias, Lactobacillus, Actinomyces, Treponema, Borrelia, Mycoplasma, Chlamydia and Rickettsiae.</p> <p>To learn the superficial and deep fungal infections of eye, ear and skin.</p>

9.	BMM-204	Lab Diagnosis of Microbial	70	To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue. To learn in detail Itiopathogenesis, pathology, clinical features and lab diagnosis of Aspergillosis, Cryptococcosis, Candidiasis, Blastomycosis, ringworms and mycetoma.
10.	BMM-205	Human Parasitology	70	To learn the Introduction and Classification of different parasitic diseases. To study the detail account of lab diagnostic procedures and special methods of demonstrations of human parasites in blood, stool, tissue and other body fluids.
11.	BMM-206	Applied Medical Microbiology	70	It provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of common infections and infestations. To impart knowledge regarding portal regulation and transport of specimen. To study the epidemiology markers of microorganisms (Serotyping and bacteriophages). To understand the specific serological methods of diagnosis. To learn the test of sensitivity to antimicrobial agents and their preparation.
		03 Practical (Course 1&2=1; 3&4=1; 5&6=1)		To impart practical knowledge and hands on training based on courses BMM-201 and BMM-202 To impart practical knowledge and hands on training based on courses BMM-203 and BMM-204 To impart practical knowledge and hands on training based on courses BMM-205 and BMM-206
3rd Year				
12.	BMM-301	Pathogenic Viruses and Associated Diseases	70	To learn the essential concepts of virology which include the structure of different viruses, properties, replication and classification of virus. To understand the different methods of viral cultivation such as tissue culture, embryonated egg and animal inoculations. To gain knowledge about the clinical features, etiology, pathogenesis and methods of laboratory diagnosis of viral infections and apply that knowledge in the treatment, prevention and control of communicable diseases caused by viruses.
13.	BMM-302	Applied immunology & Serodiagnosis	70	To gain the knowledge of immune reactions and laboratory tests for detection of antigen and antibodies. To study the Clinical significance of tumor markers and hepatitis markers. To learn the Pathogenesis and clinical feature of Autoimmune disorders markers. To be trained in Industrial production of antibiotics and vaccines. To deliver knowledge of Widal, ASO, CRP, Rose Waller, Rubella-Agglutination, cold agglutination, VDRL, TPHA and STS.
14.	BMM-303	Advanced Diagnostic Technology	70	Ability to develop and perform a range of diagnostic techniques relevant to the field of laboratory medicines. To study the classification, morphological groups and applications of bacteriophages in medical microbiology. To gain knowledge of principles, technology and applications of DNA replication, translation and transduction in diagnosis. To learn the various immunological techniques such as IgM to HB core antigen ,IgG to Hepatitis C

				virus, IgG to Hepatitis A virus, Cystecercosis IgG, Chlamydia IgM, IgG, IgA, IgM combined rapid test and dengue IgM in diagnosis of diseases.
15.	BMM-304	Automation & Computerization in Medical Micro.	70	To Acquire the knowledge of computer Hardware central Processing Unit (CPU), input drives, storage and output devices, binary decimal, octal and hexadecimal systems, BCD, EBCDIC and ASCII coding systems. To learn the Computer Application and their use in Medical Microbiology. To understand the Basic guidelines for medical transcription. To study the automation in Medical Microbiology Laboratory.
16.	BMM-305	Molecular Biology & Clinical Lab.	70	To gain the knowledge of blood glucose, liver function, blood urea and cardiac profile tests. To learn the organization, operation, administration, quality assurance and safety measures in Blood Banking. To understand the definition, classification, pathogenesis and diagnostic procedures of anemia and leukemia. To impart the knowledge of histopathology and histochemistry. To understand the Theories of Blood Coagulation & Diagnostic procedures for Coagulation disorders.
		03 Practicals (Course 1&2=1; 3&4=1; 5=1)		To impart practical knowledge and hands on training based on courses BMM-301 and BMM-302 To impart practical knowledge and hands on training based on courses BMM-303 and BMM-304 To impart practical knowledge and hands on training based on courses BMM-305 and BMM-306

Bachelor in Physiotherapy (B.P.T.)

Programme Summary

Duration: 4 years + 6 months internship

Eligibility

10+2 from the CBSE/ICSE/ State boards or intermediate or pre university examination (2 years) or any other examination recognized and equivalent to any of the above, with at least 50% marks in aggregate or in PCB.

Program outcomes:

- The aim of the course is to provide comprehensive, individually focused training that prepares the students for providing a quality Physiotherapy care to the patients.
- Demonstrate sufficient understanding of knowledge in Physiotherapy.
- Able to integrate theoretical knowledge with clinical assessment.
- Develop the ability to collect history, perform relevant clinical assessment and frame appropriate electrotherapeutic and exercise therapy management for the patients.
- Demonstrate clinical decision making ability and provide appropriate patient care.
- Develop effective communication with patients, family, colleagues and students.
- Promote health education and improved quality of life through the practice of the profession.
- To carry out research and publications towards upliftment of the field of Physiotherapy.
- Actively engage in lifelong learning activities.
- Work effectively in various inter professional collaborative settings like hospitals, Rehabilitation Centers, Special Schools, Educational Institutions, Health and Fitness Centers, Geriatric Centers, Ergonomic Consultant in Corporate Sectors, Private Consultation, Home Care Services, Industrial Sectors, Sports Management, Fitness Consultant.

Course outcomes:

S.No.	Course code	Course name	Maximum marks	Course outcomes
1st Year				
1	BP-101	Human Anatomy	70+30	<p>To understand about the structure of human body.</p> <p>To learn about the scope of anatomy in the field of Physiotherapy.</p> <p>Classification of bones, joints, and muscles</p> <p>Structure of skin, layers of skin.</p> <p>To learn about the axis and planes of body on which the movement occur.</p> <p>To understand about the structure of pectoral region, arm, forearm, hand, gluteal region, thigh, leg, ankle and foot.</p> <p>To know about the shoulder joint, elbow joint, wrist joint, hip joint, knee joint, ankle joint, sacro iliac joint, Temporomandibular joint and their movements.</p> <p>To learn about the para vertebral muscles, intercostals muscles, Brain, parts of brain, Spinal cord, Cerebrospinal fluid, IIIrd and IVth ventricles, Cerebellum, muscles of face and neck.</p> <p>To understand about thorax, heart, lungs, esophagus, abdomen and abdominal organs like Diaphragm, stomach, kidney, liver, uterus, structure of male and female reproductive organs</p> <p>To understand about the blood supply and nerve supply of all the bones, muscles and joints and other soft tissue structures.</p> <p>To understand the course of blood vessels, veins and nerves in the human body.</p> <p>To understand about the clinical aspects regarding the joints, bones and all soft tissue structures.</p>
2	BP-102	Human Physiology	70+30	<p>To understand fundamentals of cell structure and function.</p> <p>To acquire knowledge about physiology of muscle function, sliding filament theory, types of contractions, muscle fatigue.</p> <p>To know about the composition of blood, formation and functions of RBC, WBC, Plasma, and blood groups.</p> <p>To learn about the blood coagulation time, bleeding time, clotting time, blood pressure, cardiac cycle and cardiac output, examination of ECG</p> <p>To attain knowledge about respiration, mechanism of respiration, muscles performing respiration, volume and capacities of lung, and gaseous exchange.</p> <p>To know about the digestive system, gastric juices performing digestion, enzymatic activity of juices, absorption and metabolism of food.</p> <p>To understand about the structure and function of endocrine glands, hormones and their effect on every system of the human body.</p> <p>To know about the function of kidney, urine formation, normal and abnormal urine output, constituents of urine, micturition, and kidney function tests.</p> <p>To attain knowledge about the neuron, reflex arc, normal and abnormal reflexes, sympathetic and parasympathetic nervous system, sensory and motor areas.</p>
3	BP-103	General, clinical and Social	70+30	<p>To acquire knowledge about the nature and fields of Psychology, scope of Psychology in Physiotherapy.</p> <p>To obtain knowledge about behaviour and experience.</p>

		Psychology		<p>To get information about motivation, types of motivation, learning theories, nature of emotion and relationship with autonomic nervous system, Gestalt's theory of learning.</p> <p>To know about memory, its types, and causes of forgetting.</p> <p>To get information about Nature of attention, factors deterring attention; nature of perception, principles of perceptual grouping; illusions and Hallucinations.</p> <p>Mental mechanisms and their role in health and disease.</p> <p>Psychological reaction of patients to physical illness, reaction to loss, death, bereavement. Emotional needs and Psychological factors in relation to unconsciousness handicap.</p> <p>To know about intelligence tests – their uses; how the test is standardized Intelligence Quotient (I.Q.) general intelligence and special intelligence.</p> <p>To understand the concept of Personality, types, measurement of Personality with the help of various Questionnaire</p>
4	BP-104	Biochemistry	70+30	<p>To understand the concepts of Biochemical organization of human cell.</p> <p>Learn experimental evidences for proteins and physiotherapeutic significance of structural proteins. To know about the biochemical aspects of hemoglobin, connective tissue, muscle tissue and nervous tissue, protein, carbohydrate and lipid metabolism.</p>
5	BP-105	Basic principles of Physiotherapy	70+30	<p>To study the definition, branches and scope of Physiotherapy in day today's life.</p> <p>It includes general knowledge of electrotherapy modalities with reference to current and magnetism, conductors and non conductors, light, heat and cold, and exercises like active and passive exercises, resistive exercises.</p> <p>It gives knowledge about wax therapy, pulleys, gym ball, fundamental positions, walking pattern.</p>
6		Laboratory course 1	70+30	
7		Laboratory course 2	70+30	To learn about physiologic examinations like blood sampling, clotting time, bleeding time, platelet count, RBC and WBC count
2nd Year				
1	BP201	Exercise Therapy	70+30	<p>To understand the principles and techniques of relaxation and its principles.</p> <p>To learn the use of suspension for treatment. Use of various techniques like PNF, Hydrotherapy their principles for treating various conditions.</p> <p>To learn evaluation methods – Principles – techniques of muscle testing, goniometry, limb girth and length, posture, chest expansion and hand function.</p> <p>To learn various soft tissue manipulations.</p> <p>Learning the normal gait pattern and correction of gait abnormalities.</p> <p>To learn the various techniques of mobilization, 7.strengthening and stretching along with their principles.</p> <p>To learn the basic concepts of various types of co-ordination exercises, breathing exercises ADL, hand function.</p> <p>To learn the different types of traction, and its uses.</p> <p>To learn the history of yoga and various types of asana along with the advance yoga therapy and its therapeutic utilities.</p>
2	BP202	Electrotherapy	70+30	Learning the basic of all low frequency current modalities like, TENS, muscle stimulator, di-dynamic and

		and Actinotherapy		<p>sinusoidal currents, their indications and contra indications.</p> <p>To learn the nature, indications and contra indications of various medium frequency current modalities like IFT and Russian currents.</p> <p>Learning the physiological and therapeutic effects of high frequency currents and their uses for various conditions, modalities are SWD and MWD.</p> <p>Learning the use of various radiations for treatment purpose like, UVR, IRR and LASER.</p> <p>To learn the therapeutic uses of Ultrasound, its physiological effects, indications and contra indications.</p> <p>To learn about various thermotherapy techniques like, paraffin wax bath, contrast bath and moist heat therapy for treating various conditions.</p> <p>To learn about various diagnostic techniques like biofeedback, SD curve, NCV and EMG to know about the condition of muscles and nerves and use the information to treat the conditions.</p> <p>To learn the various advanced techniques of treatment like combination therapy, long wave, and treating some conditions using techniques of cryotherapy.</p>
3	BP203	Biomechanics and Kinesiology	70+30	<p>Introduction to kinesiology, learning fundamental concepts of COG, LOG, planes, axis and starting positions.</p> <p>To learn about body musculature, all joints, reflexes, muscle tone and all neuromuscular functions.</p> <p>Fundamentals of anatomical levers, pulleys, and principles of motion.</p> <p>Fundamental principles of force and work- Force and its magnitude, direction, point of application, components of muscular force, components of external force, graphic representation of force, true force and the resistance arms of the lever, the confused affects of two or more forces.</p> <p>Principles of Stability, covering all the joints.</p> <p>Application of Kinesiology to Locomotion, Biomechanics of all phases of gait cycle.</p> <p>Evaluation of exercise for conditions like kyphosis, lordosis, scoliosis etc for corrective purposes.</p>
4	BP204	Pathology microbiology	70+30	<p>Introduction to etiology and classification of diseases.</p> <p>To learn various types of inflammations.</p> <p>Introduction to wound and its healing.</p> <p>Learning various degenerative and metabolic disorders of bone, tumors, and fractures.</p> <p>To learn the pathology of CNS diseases and peripheral nerve diseases.</p> <p>Diseases of respiratory, CVS, and musculoskeletal system.</p> <p>Introduction and Historical background of microbiology</p> <p>Discovery of micro organisms.</p> <p>To learn the contribution of various scientists in the field of microbiology.</p> <p>To learn the chemotherapy basics and vaccination.</p> <p>To learn the microbial structure, function and culture media.</p> <p>To learn about main pathogens and human body immunity, antigen antibody reaction.</p> <p>Types of infections.</p>
5	BP205	Pharmacology	70+30	<p>Learning definition of Pharmacology and its scope in Physiotherapy.</p> <p>To learn Dosage forms & Modes of Drugs administration, drug absorption, metabolism and Biotransformation.</p>

				<p>Basic concepts of drug toxicity, allergy and drug resistance. Learning pharmacodynamics, drug potency and drug antagonism. To learn the pharmacology and physiotherapeutic role of following Pharmacodynamics agents. General and local anesthetics, anxiolytics, anticonvulsants, sedatives, antihistaminic agents, anti-inflammatory analgesic agents, neuro-muscular blockers and muscle relaxants. Introduction to drug classification, effects and side effects of some drugs.</p>
6		Laboratory course 1	70+30	To learn about various types of exercises, manipulations, mobilization, joint range by goniometry and learning various yoga asana.
7		Laboratory course 2	70+30	To learn the practical application of various modalities for different conditions , learning indications and contraindications, and to learn what are the precautions to be taken in an electro lab and how to work with patients and modalities.
8		Laboratory course 3	70+30	Evaluation and assessment of various joint motions posture and gait. To evaluate various soft tissues.
3rd Year				
1	BP-301	Clinical Orthopedics	70+30	<p>Basic introduction to orthopedics, general idea about terminology, deformity, diseases of bones, joints and soft tissues Clinical features, investigations and treatment of bone and joint infection General diseases of bones and joints like RA, AS, gout, rickets etc Regional diseases of ligaments , menisci and tendons Types, features, complications and surgical management of fractures Diseases of spine Regional conditions like deformities of hand, foot etc, tennis elbow, VIC etc Clinical features, assessment, types and treatment of leprosy, CP, PNI, polio and amputation</p>
2	BP-302	Clinical neurology and psychiatry	70+30	<p>Review the anatomy and physiology of nervous system. Clinical features and management of congenital disorders. To study in detail the clinical features , investigation and treatment of brain vascular diseases like stroke and head injury. Features, assessment and treatment of spinal cord disorders like tumors, syringomyelia, etc. To know about the demyelinating and degenerative diseases and their treatment like GBS, Parkinson's etc To study about the cranial nerves and their diseases. To know about the nerve and muscle diseases and their management. To understand some of the psychiatric disorders like MR, schizophrenia etc.</p>
3	BP-303	Clinical cardiothoracic conditions	70+30	<p>To review the basic anatomy and physiology of heart and lungs. To understand the basic principles of cardiothoracic assessment and investigations. To study the thoracic cage deformities. Common conditions of cardiovascular system like cardiac failure, CHD, IHD etc. To know the common cardiac surgeries, types of incisions, pre and postoperative management Common respiratory diseases like asthma, TB, etc. Thoracic surgeries like thoracoplasty.</p>
4	BP-304	General	70+30	To understand the concepts of medicine and general medical conditions

		medicine , skin and pediatrics		Learn clinical features, assessment and medical management of heart diseases, respiratory diseases, digestive system diseases, kidney and genitourinary system, blood diseases, skin and pediatric diseases
5	BP-305	General surgery, obg, gyne, ent and plastic surgery	70+30	To study the clinical features, pathology and management of hemorrhages, about anesthesia and pain relief. General and plastic surgery procedures and their management. To understand the anatomy and physiology of ear, nose and throat and their diseases. To know about some obs and gynecological disorders and their management.
6	BP-306	Disability, prevention and rehabilitation	70+30	To understand the basic terminologies in rehabilitation To know the ethics in hospital and work To understand the interdepartmental relationships, with patients, family members and community To know the basic philosophy of rehabilitation and its use in some conditions To know the social and vocational problems and how to deal with them
7		Lab course 1	70+30	Demonstration and practice of general orthopedic examination. Discussion of common orthopedic appliances and instrument.
8		Labcourse 2	70+30	Demonstration and practice of neurological examination. Discussion about investigations in neurology like CT,MRI etc
4th Year				
1	BP 401	PT in Orthopedics	70+30	Detailed study on causes, types and management of fractures. With detailed study on assessment, investigations of fractures and dislocations of upper limb, lower limb and spine. Detailed assessment, diagnostic test, management of Soft Tissue Injuries of upper & lower limb. Degenerative and infective conditions of joints Deformities of joints and spinal column with investigations & management. Orthopedic Surgery of upper/lower limb with pre & post rehabilitation. Amputation causes & management .low back pain with causative factors, tests and its rehab.
2	BP 402	PT in Neurology	70+30	Evaluation and application of advanced neuro rehab techniques for rehabilitation. Evaluation, assessment of various neurological disorders. Peripheral injuries and neuropathies rehabilitation. Assessment and treatment of paralytic conditions.
3	BP403	PT in Cardio thorasic conditions	70+30	Detailed evaluation and procedures for cardiac rehab including management in ICU. Physiotherapy management of various cardiac disorders along with management of complications of peripheral vascular problems. Pre and post operative Physiotherapy management of various heart surgeries.
4	BP404	PT in Gen. Medical and surgical conditions	70+30	Physiotherapy management of systemic diseases, Oedema, Inflammation, Artherosclerosis, Aneurysms, Tumors, Rickets Diabetes, Panniculitis, obesity, Lymphedema, tetanus. Physiotherapy management pre and post operative for all abdominal surgeries. Physiotherapy management of various skin disorders. Physiotherapy management of gynecological conditions including bladder management. Physiotherapy management of ENT disorders. Skin grafting and flaps, liposuction, mamoplasty, Rhinoplasty & it PT management. Physiotherapy management of various pediatrics neurological disorders. Physiotherapy management of various sports injuries.

5	BP405	Research methodology, biostatistics and computer	70+30	Measurement of Central Tendency (mean, median mode). Theory of probability – Definition, Mathematical definition, Law of Probability (Addition and Multiplication theorems). Condition Probability, expectations – expected values or the mathematical expectation, addition and multiplication theorem on expectation. Test-t-test, f-test and X^2 – test Correlation and regression line:- Computer: Application, Soft and Hardware, Application in Medicine, Programming etc. Modern concept of Computer Technology in Rehabilitation of persons with disabilities.
6		Lab course 1	70+30	Practicals include detailed assessment of all joints with relevant diagnostic tests.
7		Lab course 2	70+30	Practicals include evaluation, assessment of various neurological disorders, application of various approaches.
8		Lab course 3	70+30	Practical's various techniques for management in ICU, respiratory care techniques of postural drainage.
9		Lab course 4	70+30	Practical assessment of various medical & surgical conditions, diagnostic tests techniques for rehabilitation.