BHAGWANT UNIVERSITY

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Sikar Road, Ajmer

RAJASTHAN

Syllabus

B.Sc. (FORESTRY)

2013-2014

B.Sc. (Forestry)

I. Semester.

Subject Code	Name of Subject	Teaching Periods		Credit Points
01BSF101	Introductory Forest Economics	2	0	2
01BSF102	Fundamentals of Geology and Soil Science	1	1	2
01BSF103	Agrometeorology	1	1	2
01BSF104	Plant Biochemistry and Biotechnology	2	1	3
01BSF105	Principles of Cytology and Genetics	1	1	2
01BSF106	Tree Physiology	2	1	3
01BSF107	Introductory Botany	2	1	3
01BSF108	Basic Mathematics	3	0	3
01BSF109	Principles of Plant Physiology	1	1	2
01BSF301	DACA	0	1	1
Total		**15**	**8**	**23**

01BSF101 Introductory Forest Economics 2(2+0)

Nature and scope of economics and its relationship with other sciences. Theory of consumption. Marshallion theory of utility, equimarginal utility and Hicks-Allen approach for determining consumer equilibrium. Concept and types of demand, laws of demand and factors affecting demand of commodities. Elasticity - its kinds, measurement and factors affecting it. Factors of production, their definition and characteristics, Law of diminishing marginal returns. Supply - definition, law and elasticity. Market - its classification and price determination under different market situation. Introduction to distribution theories with particular reference to Ricardian Theory of Rent. Marginal productivity theory of wages, Liquidity preference theory of interest, Marginal Productivity theory, risk taking and uncertainty bearing theories of profit. National Income and its concepts. Concept and types of inflation.

01BSF102 Fundamentals of Geology and Soil Science 3(2+1)

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. Problem soils: salted soils, permeable, flooded, sandy soils properties. Physical parameters texture-definition-methods of textural analysis-Stock's law-assumption-limitations-textural classes-use of textural triangle, absolute specific gravity-definition-apparent specific gravity/bulk density-factors influencing-field bulk density. Relation between BD.PD-Practical Problem. Pore space-definition-factors affecting capillary and non-capillary porosity-soil colour-definition-its significance-colour variable-hue, value, chroma, Munsell colour chart-factors influencing-parent material-soil moisture-organic matter, soil structure-definition-classification-clay prism like structure-factors influencing genesis of soil structure, soil consistency plasticity-Atterberg's constants. Soil air-air capacity-composition-factors influencing-amount of air space-soil air renewal, soil temperature-sources and distribution of heat-factors influencing-measurement, chemical properties-soil colloids-organic-humus-inorganic-secondary silicate-clay-hydrous oxides. 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-pressure plate. and pressure membrane apparatus-Neutron probe-soil water movement-saturated and unsaturated-infiltration and percolation-soil survey - classification-aerial photography-satellite-their interpretation, soil orders-land capability-classification, soils of different eco-systems and their properties; water quality parameters and assessment.

Practical: Identification of rocks and minerals; Collection and preparation of soil samples; Soil analyses for moisture, colour, bulk density, organic matter, pH, EC; Textural analysis by hydrometer method; Study of soil profile I & II; Excursion tour for identification of rocks and minerals and profile studies; Practical introduction to Tensiometer, pressure plate and neutron probe etc.

01BSF103 Agrometeorology 2(1+1)

Agrometeorology-definition, aim and scope. Factors and elements of weather and climate. Composition and structure of atmosphere. Air and soil temperature regimes, atmospheric humidity, types of clouds and precipitation, hails and frost. Cyclones, anticyclones and thunderstorms. Solar radiations-components and effect on plant growth. Wind as a source of energy. Effect of weather and climate on the growth and development of crops. Climatic normals for crops. Agroclimatic zones of India and Himachal Pradesh. Evaporation and transpiration. Use of remote sensing techniques in agrometerology. Agriculture weather forecasting.

Practical: Study of temperature instruments, pressure instruments, humidity instruments, wind instruments, rain instruments and wind rose. Solar radiation instruments with pyranometer. Monthly variation of rainfall at Nauni. Lay out of an agromet observatory and types. Measurement of wind and evaporation. Measurement of sunshine hours. Measurement of soil temperature and dew.

01BSF104 Plant Biochemistry and Biotechnology 3(2+1)

Carbohydrates-occurrence and classification-structures of glucose, fructose, ribose, maltose, lactose, starch and cellulose, physical and chemical properties of carbohydrates-isomerism, optical activity, reducing property, reaction with acids and alkalis-osazone formation. Lipids-classification-important fatty acids and triglycerides, essential fatty acids -rancidity of oilsacids value, saponification value & iodine value -phospholipids-types and importance-plant pigments-structure and function of chlorophyll and carotenoids-sterols-basic structure. Protein - classification - functional and solubility - amino acids-classification and structure-essential amino acids - properties of amino acids-colour reactions, amphoteric nature and isomerism-structure of proteins - primary, secondary, tertiary and quaternary properties and reactions of proteins. Enzymes-classification and mechanism of action-factors affecting enzyme action-cofactors and coenzymes - vitamins and mineral as coenzymes/cofactors-carbohydrate metabolism-glycolysis and TCA cycle-metabolism of lipids - lipases and phospholipases-fatty acid oxidation. Biosynthesis of fatty acids, protein metabolism-proteolytic enzyme, electron transport chain-ATP formation, bioenergetics of glucose and fatty acids. Photosynthesis and nitrogen fixation structure and component of nucleic acids, replication, transcription and translation. Historical developments in bio-technology. Application of plant tissue culture in plant improvement Micropropagation: Principales and application in forestry trees and medicinal plants; meristem culture; plant cell and suspension cultures; organogenesis and regeneration in vitro and somaclonal variations; genetic engineering techniques; transgenic plants with case studies of tree species to diseases, production of secondary metabolities; germplasm conservation; An introduction to bioinformatics, genomics and proteomics, biodegradation of forestry wastes through genetically engineered microbes.

Practical: Preparation of standard solutions and reagents - carbohydrates - qualitative reactions, estimation of starch, reducing and non-reducing sugars-reactions of proteins and amino acids-estimation of proteins by Lowry method - determination of acid value, saponification value, iodine number of vegetable oils-vitamins-estimation of ascorbic acids-paper and thin layer chromatography. Sterilization techniques; preparation of culture medium for establishment of explants of forestry plants, multiplication of shoots, induction of roots; meristem culturing; callus cultures, induction of organogenesis;

105BSF105 Principles of Cytology and Genetics 3(2+1)

History of genetics and hypothesis-theories. Physical basis of heredity, cell reproduction -mitosis - meiosis and its significance. Gametogenesis and syngamy in plants. Mendel's principles of heredity, deviation from Mendelian inhritance, pleiotropy, threshold characters, co-dominance pentrance and expresivity.. 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

Practical: Study of fixatives and stains; Preparation of slides showing various stages of mitosis; Preparation of slides showing various stages of meiosis; Testing the viability and germination of pollen grains; Solving the problems on monohybrid and dihybrid crosses; Estimation of linkages/ chromosome mapping.

01BSF106 Tree Physiology 3(2+1)

Tree structure, growth, development, differentiation and reproduction. Plant growth functions and growth kinetics, Physiological functions and processes in trees. Environmental effects on growth and development. Productivity of tropical deciduous and evergreen forests. Light use efficiency in forest species, canopy structure, plant phyllotaxis and its importance in translocation. Plant light relationship environment. Branching in isolated plants. Monoculture and mixed tree communities. LAI, Photosynthetic efficiency and respiratory losses, source-sink relationship, Factors affecting photosynthesis. Radiation interception, absorption of water, ascent of sap and water balance. Transport processes with special reference to long distance transport in trees and its impact on plant water relations and photosynthesis. Development of seeds and seedlings. Biocides and growth regulators in forest ecosystems. Senescence and abscission. Role of trees in pollution control.

Practical: Measurement of growth and growth kinetics in seedlings; Measurement of linear growth in tree species; Biometric measurement of plant growth; Estimation of evapotranspiration; Measurement of WUE in trees; Pattern of light interception in different canopy architecture; Measurement of light use efficiency in tree species, using plant efficiency analysis; Growth as influenced by different spectral bands in visible light; Source sink relationship in plants; Translocation studies in plants; Effect of growth promoters on plants; Effect of growth retardants on plants; Use of biocides in tree species; Dormancy and germination studies in tree species; Methods of breaking dormancy in tree species; Studies on senescence in tree species; Regulation of senescence in tree species using agrochemicals; Chemical composition of tree species including shrubs, herbs and wood.

01BSF107 Introductory Botany 3(2+1)

Introduction to Botany and general classification of plants. Parts of a typical flowering plant. Morphology of root, stem, leaf and flower. Structure and types of plant tissues. Internal structure of Dicot and Monocot Stems, Roots and a typical Leaf. Significance of life cycle with special reference to alternation of generations in *Chlamydomonas, Rhizopus, Funaria, Adiantum, Pinus* and a flowering plant. Importance of plants in relation to environments.

Practical: Morphological studies of roots, stems, leaves and flowers. Studies of permanent slides of histology and anatomy. Morphological studies of gametophytes and sporophytes of the plants pertaining to the life cycle. General survey of the local vegetation. A field trip during the semester.

01BSF108 Basic Mathematics 3(3+0)

Elementary idea of complex number. Arithmetic and Geometric progressions. Elementary idea of permutation and combinations. Binomial theocrem for positive integral index, any index and their applications, addition and substraction formulae. A, B and C, D formulae. Sine and Cosine formulae. Inverse Trignometric functions. Introduction to matrices and determinants, special type of matrices, addition, substraction and multiplication of matries. Inverse of a matrix solution of system of linear equations using Cramer's rule and matrices method. Measures of central tendency and dispersion. Correlation and Regression. Elementary idea of probability theory.

01BSF109 Principles of Plant Physiology 2(1+1)

Water relations in plants: role of water in plant metabolism, osmosis, imbibition, diffusion, water potential and its components, absorption of water, mechanisms of absorption, ascent of sap. Stomata, structure, distribution, classification, mechanisms of opening and closing of stomata, guttation, transpiration, factors affecting transpiration. Different types of stresses: water, heat and cold tolerance, mechanism of tolerance. Plant nutrition: essentiality, mechanism of absorption, role in plant metabolism, Photosynthesis, importance of photosynthesis, Structure and function of chloroplast, dark and light reactions, CO_2 fixation, C_3, C_4 and CAM, advantages of C_4 pathway, photorespiration and its implications. Factors affecting the photosynthesis. Respiration, glycolysis, TCA cycle and Electron transport chain, ATP synthesis and factors affecting the respiration. . Photohormones, physiological role in controlling plant process. Environmental stimuli for plant development.

Practical: Measurement of water potential by different methods, Osmosis - demonstration, Plasmolysis - demonstration, Root pressure - demonstration, Transpiration rate, Studying the structure of stomata, studying the opening and closing of stomata, Demonstration of importance of light in photosynthesis, Separation of xanthophyll, Chlorophyll in plants, Studying the activity of catalase, Detection of phenols in plants, Studying the plant movements, Root initiation in cuttings.

II. Semester.

Subject Code	Name of Subject	Teaching Periods		Credit Points
02BSF101	Principles and Practices of Silviculture	3	1	4
02BSF102	Dendrology	2	1	3
02BSF103	Forest Ecology, Biodiversity & conservation	1	1	2
02BSF104	Principles of Hydrology, Soil & Water Conservation	2	1	3
02BSF105	Chemistry and Fertility of Forest Soils	2	1	3
02BSF106	Forest botany and Ethnobotany	2	1	3
02BSF107	Fundamental of Horticulture	1	1	2
01BSF301	DACA	0	1	1
Total		**13**	**8**	**21**

02BSF101 Principles and Practices of Silviculture 4(3+1)

Definition of forest and forestry. Classification of forest and forestry, branches of forestry and their relationships. 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 climatic factors. Role played by light, temperature, rainfall, snow, wind, humidity and evapo-transpiration in relation to forest vegetation. Bioclimate and micro climate effects. Edaphic factors -influence of biological agencies, parent rock, topography on the soil formation. Soil profile -physical and chemical properties, mineral nutrient and their role, soil moisture and its influence on forest production. Physiographic factors - influence of altitude, latitude, aspect and slope on vegetation. Biotic factors - influence of plants, insects, wild animals, man and domestic animals on vegetation. Impacts of controlled burning and grazing. Influence of forests on environment. 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.

Practical: Acquaintance with various technical terms. Visits to different forest areas/types. Study of forest composition. Recording the observations on shoot development, growth rings, crown development, leafing, flowering and fruiting in a few selected tree species. Study of site factors like climatic, edaphic, physiographic and biotic. Study of forest succession. Study of the afforestation and reforestation success.

02BSF102 Dendrology 3 (2+1)

Introduction - importance and scope of dendrology, Morphology of woody plants and range of variation. Principles and systems of classification of plants. Bentham and Hooker's,

Engler and Prantles, and Hutchinson's Systems. Plant Nomenclature - objectives, principles and International Code of Botanical Nomenclature. Role of vegetative morphology in identification of woody forest flora. Peculiarities of tree stems, twigs, general form of woody trunk and deviations like buttresses, flutes, crooks, etc. Morpholog and description of barks of common trees. Characteristics of blaze on bark, colour, gums, latex, etc. Morphology of leaf, description of different types of leaves, colour of young and old leaves in some species as (regular) features of identification. Reproductive morphology of plants with reference to description and identification of reproductive parts. Floristics and procedures; herbarium techniques, collection, processing and preservation of plant material. General study of herbarium, arboretum and xylarium. Description of the plant in scientific terms, study of sport characteristics of plants, naming and classifying based on adopted system. Study of families, as survey of forest resources: Magnoliaceae, Rhizophoraceae, Ebenaceae, Sapotaceae, Caesalpiniaceae, Santalaceae, Mimosaceae, Elaeagnaceae, Papilionaceae, Meliaceae, Salicaceae, Apocynaceae, Betulaceae, Verbenaceae, Fagaceae, Compositae, Moraceae, Poaceae, Tiliaceae, Liliaceae, Euphorbiaceae, Pinaceae, Dipterocarpaceae, Cupressaceae, Guttiferae, Taxaceae, Myrtaceae and Combretaceae. Geographical distribution of important Indian trees, native trees, exotic trees, endemism, allelopathy with respect to forest trees.

Practical : Morphological description of plant parts and method of collection of plants. Techniques of preparing herbarium specimens. Study of woody flora of: Magnoliaceae, Ebenaceae and Tiliaceae; Leguminosae, Betulaceae, Fagaceae; Dipterocarpaceae, Guttifereae and Liliaceae; Moraceae and Poaceae; Meliaceae, Elaeagnaceae and Salicaceae; Legumenosae and Apocynaceae; Combretaceae, Lythraceae, Myrtaceae and Santaleceae; Asteraceae, Ebenanceae, Sapotaceae and Verbenaceae; Euphorbiaceae, Pinaceae, Cupressaceae, Taxaceae.

03BSF103 Forest Ecology, Biodiversity and conservation 3(2+1)

Historical development of ecology as a science. Concept of levels of biological organization. Ecosystem - classification and distribution. Forest environment- Major abiotic and biotic components and their interaction, Nutrient cycling, trophic levels, food webs, ecological pyramids and energy flow. Population ecology - definition, population dynamics and carrying capacity, preparation of life table and its importance in forest management. Community ecology - Species interaction, Ecological succssion, terminology, basic concepts, climax vegetation types, Methods to study effects of forest management on succession. Island Biogeography. Autecology of important tree species. Biodiversity and conservation -definition, levels of study, distribution of diversity in life forms, hotspots of biodiversity, measurement of diversity and diversity indices. Principles of conservation biology, Ex

situ and In situ methods of conservation, Genetical and evolutionary principles in conservation. Biosphere concept. Conservation - efforts in India and worldwide.

Practical: Estimating productivity of a site; Study of microclimate and forest soils; Study of ecological modifications of leaves; Effects of fire on forest ecosystem; Study of population dynamics using model systems; Preparation of life tables; Study of spatial dispersion among plants; Study of Forest composition; Niche analysis; Computation of diversity indices; Measurement of diversity of plants and insects in a near by forest; Study of succession in field and water bodies; Visit to different ecosystems.

02BSF104 Principles of Hydrology, Soil and Water Conservation 3(2+1)

Definition and importance of Hydrology, Hydrological cycle, weather and hydrology, rainfall measurement and analysis, hydrologic properties, infiltration, runoff, water holding capacity of soils, free water, capillary water, hygroscopic water, ground water, evapotranspiration, water yield, interception by stemflow through fall, study of hydrographs. Recharging of water wells and springs. Wasteland Management: Objectives, components, runoff, factors affecting runoff, stream flow and stream gauging. Sedimentation, factors affecting sedimentation, flood and its control measures. Afforestation and forest management in wasteland areas. Soil erosion, universal soil loss equation, soil and water conservation practices and soil conservation structure like contour and graded bunding. Bench terracing and bench bank stabilization. Waterways their design, layout, construction, stabilization and maintenance. Methods of land leveling, its cost estimation, their location and design. Water harvesting structures and farm ponds. Irrigation Source: Water wells, aquifers, water application methods; surface, subsurface, drip and sprinkler irrigation system. Drainage: types of drainage systems, their selection, design, installation and maintenance.

Practical: Study of hydrological equipment; Measurement and analysis of rainfall data; Estimation of runoff using rational formula; Preparation, use and analysis of hydrograph; Measurement of evaporation by different methods; Study of flood control reservoirs; Drainage and reclamation of water logged lands; Measurement of irrigation water by various method; Design of graded bunds; Design and layout of waterways; Survey design and layout of bench terraces; Design and layout of diversion channels; Study of different water harvesting structures; Land leveling and its cost estimation; Study of drip irrigation system; Study of sprinkler irrigation system; Study of pumping system; Economic analysis of wasteland development.

02BSF105 Chemistry and Fertility of Forest Soils 3(2+1)

Introduction; Forest soils Vs. cultivated soils. Properties of soils under different forest ecosystems. Soil colloids and exchange phenomenon. Essential nutrient elements-occurrence, availability and their functions. Diagnosis of nutrient deficiencies-visual symptoms, soil fertility evaluation methods. Site productivity and nutrient cycling in forest soils. N,P and K, Macro and micronutrient fertilizers and their uses. Brief history of Microbiology. Forest soil environment-distribution of various microorganisms in soil ecosystem and their interaction effects. Mineral Transformation-carbon cycle with reference to organic matter decomposition and humus formation, Microbial degradation of cellulose & lignin. Bio-fertilizers - their importance. Nitrogen fixation-Rhizobium-tree legume symbiosis, Frankia X non-legume symbiosis, asymbiotic and associative N_2 fixation. Nitrification and denitrification in forest ecosystems. Microbial transformation of phosphorous, sulphur and micro nutrients. Mycorrhizae: types, biology and importance with specific relevance to tree crops and mobilization of phosphorus and micro-nutrients. Rhizosphere and phyllosphere concept.

Practical: Study of forest soil profile; Determination of C.E.C. and exchangeable cations; Determination of soluble cations (Ca,Mg,Na, K); Determination of soluble anions (HCO_3,CO_3,Cl, SO_4); Determination of available N, P & K content of soil; Basic sterilization techniques; culturing and maintenance of micro organism occurring in soil; Staining methods; Study of decomposition of forest litter by CO_2 - evolution method; Estimation of nitrification rate in soil; Isolation of legume bacteria and Azotobacter; Preparation and inoculation techniques for mycorrhizae and biofertilizers.

02BSF106 Forest botany and Ethnobotany 3(2+1)

Definition and scope of ethnobotany. Man and biological resource of earth with respect to plants. Terms employed in relation to ethnobotany and its relationship with man and domestic animals. Ethnic - people and their contribution in therapeutic and ethnobotanical knowledge especially with respect to medicinal and allied aspects. Important plants and their folk uses for medicines, food, dyes,

tans, etc. Symbolic relationships including mythology mainly from the following families. Guttiferae (Clusiaceae), Rosaceae, Malvaceae, Fabaceae, Mimosaceae, Caesalpinaceae, Combretaceae, Umbelliferae (Apiaceae), Rubiaceae,

Asteraceae, Ebenaceae, Apocynaceae, Asclepiadaceae, Euphorbiaceae, Lauraceae, Palmaceae, Poaceae, Liliaceae, Coniferae, Santalaceae, Thymeliaceae.

Practical: Visit to various places to collect information regarding traditional uses of plants. (This also includes nearby tribal areas).

02BSF107 Fundamental of Horticulture 2(1+1)

Economic importance and classification of horticultural crops and their culture and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery management practices, soil and climate, vegetable gardens, nutrition and kitchen garden and other types of gardens - principles, planning and layout, management of orchards, planting systems and planting densities. Production and practices for fruit, vegetable and floriculture crops, nursery techniques and their management. Principles and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water management, weed management, fertility management in horticultural crops, cropping systems, intercropping, multi-tier cropping, mulching, bearing habits, factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working , frame working, principles of organic farming.

Practical: Features of orchard, planning and layout of orchard, tools and implements, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits and vegetables, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

III. Semester.

Subject Code	Name of Subject	Teaching Periods		Credit Points
03BSF101	Forest Engineering & Survey	1	1	2
03BSF102	Wood Anatomy	1	1	2
03BSF103	Logging & Ergonomics	1	1	2
03BSF104	Soil Survey, Remote Sensing & Wasteland Development	2	1	3
03BSF105	Forest Mensuration	2	1	3
03BSF106	Principles and Methods of Tree improvement	2	1	3
03BSF107	Tree Seed Technology	1	1	2
03BSF108	Tribology and Anthropology	2	0	2
03BSF109	Structural Grammar and Spoken English (NC)	1	1	2
01BSF301	DACA	0	1	1
Total		**13**	**9**	**22**

03BSF101 Forest Engineering & Survey 2(1+1)

Engineering survey, scope and types of surveying, chain surveying, types and instruments used; Traversing, triangulation, survey stations, base line, check and tie lines; ranging of survey lines; offsets and their types; chain of sloppy grounds, chaining across obstacles; cross staff surveying, compass surveying, chain and compass traversing, magnetic and true bearings, prismatic compass, local attraction. Computation of interior angles and balancing of closed traverse. Plane table surveying; plane table and its accessories, methods of plane table surveying. Leveling: terms used, types of levels, dumpy level and its adjustments, booking of staff readings, calculation of reduced levels. Theodolite and its uses. Contour surveying. Building materials - types, strength and characteristics, site selection for building construction. Forest roads - alignment, construction and drainage; retaining walls, breast walls, waterways and culverts; bridges - types, selection of site, simple wooden beam bridges, check dams, spurs, farm ponds, earth dams.

Practical: Chain surveying, compass traversing; Plane table surveying, leveling, calculations of earth work for construction of forest; Roads & earth dams; Alignment of forest roads; Preparation of building plans; Design of waterways; Design of simple wooden beam bridge; Design of retaining walls; Design of check dams

03BSF 102 Wood Anatomy 2(1+1)

Introduction to Wood Anatomy. The plant body - Cell and organelles, meristems, promeristem, primary meristem, secondary meristem, apical and intercalary meristems. Simple tissues- parenchyma, collenchyma, sclerenchyma. Complex and vascular tissues. Anatomy of stems and roots of dicots and monocots. The secondary growth in woody plants. Mechanism of wood formation. Formation of early and late wood, growth rings, transformation of sapwood to heartwood. The macroscopic features of wood, bark- sapwood, heartwood, pith, growth rings, wood rays, resin or gum-canals. Cell inclusions. Physical properties of wood; colour, hardness, weight, texture, grain, lusture, etc. Abnormalities in wood -- deviation from typical growth form (leaning, bending, crook, fork, buttress), grain deviation, false and discontinuous growth rings. Reaction wood-compression and tension wood. Disruption of continuity of inner wood, shakes, included bark, resin pockets, pith flecks, knots (live and dead).

Practical: Study of primary growth in typical dicot stem; Study of vascular bundles in monocots; Study of three dimensional features (cross, radial and tangential planes) of logs (woody trunks); Comparative anatomical features of softwoods and hardwoods; Study of gross features of different types of wood- straight, interlocked, spiral and wavy grain; texture; lusture; etc.; Study of anatomical features of different types of wood pores /vessels; Study of soft tissues in timbers and their distribution; Study of wood rays and their types; Study of non-porous woods, their physical and anatomical description; Study of cell inclusions in wood.

03BSF 103 Logging and Ergonomics 2 (1+1)

Definition and scope of logging, logging plan and execution. Location and demarcation of the area for logging and estimation of produce available for extraction. Implements used in logging operation-traditional and improved tools. Felling rules and methods. Conversion, measurement and description of converted material. Means of transport of timber- carts, dragging, skidding, overhead transport, ropeways, skylines. Transport by road and railways. Transport by water- floating, rafting and concept of booms. Grading and Storage of timber in the depots for display and disposal, temporary and final storage. Timber Depots- types, lay out and management. Systems of disposal of timber. Size of material in logging operation. Ergonomics: definition, components and provision of energy. Requirement of energy and rest periods. Effect of heavy work, posture, weather and nutrition. Personal protective equipments, safety helmets, ear and eye protections. Accidents: causes, statistics, safety rules and first aids. Plants, animals and insect infestations; diseases and their prevention.

Practical: 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; Information procedure regarding handing and taking over before starting actual logging operation. Contract letters and other formalities to be completed; Equipments and tools used in logging operations and their uses; Planning and execution of different logging operation in a phase wise manner; Application of felling rules in the forests for felling of standing trees at different localities; Instructions regarding maintenance of various records and registers in logging operations; Conversion of felled trees into logs, poles,

firewood, pulpwood etc.; Measurement of logs, poles and firewood in forests and maintenance of records in relevant registers; Minor and other types of transport practicable at felling sites; Final transport, information regarding transit permits for various types of forest produce; Visit to local dumping yard (timber depot) to trace the logs delivered from different forest sites; Sorting of logs, poles and firewood in the depots according to species, quality, length and girth classes; 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; Lotting of the stacks for display and final disposal; Recording of the lots for auction sale. Final disposal of the material; Visit during the auction sale in the government timber depots; Preparation of ergonomic check lists.

03BSF 104 Soil Survey, Remote Sensing and Wasteland Development 3(2+1)

Scope and objective; soil survey, sampling methods; planning, inventory, permanent sample plots; sample size allocation, landuse classes and planning. Aerial photography and remote sensing-definition, meaning, scope, merits and brief history. 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. Photogrammetry: Vertical and oblique photography. Photographs and images, scales, resolution, photo interpretation, photogrammetry, image analysis, mapping. Agencies involved in remote sensing and acquiring information from them. Remote sensing; principles, uses in forestry, status monitoring, fire, vegetation/cover classification and mapping, species identification, height and volume - estimation. Identification of tree species and their form stand delineation. 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. Characterization of wasteland, present status and extent of non-arable lands and their productivity. Salt affected soils, lateritic, marsh and swampy and rocky hills, rocky plains, murrammy and sandy soils, their characteristics and reclamation. Sites with superficial impervious hard pan. Eroded ravines and gullies, various techniques of afforestation of adverse sites, trees suitable for adverse sites. Afforestation and reclamation of mine wastes. Stabilization of tailing dumps and prevention of dust pollution. Sewage water as source of tree nutrients.

Practical: Exercise on sampling methods; Exercises on land use classes; Exercises on light-spectral characteristics; Study of equipment and materials used in aerial photography and remote sensing; Study of scales; Case studies-aerial photography and satellite imageries; Case studies - Geographic Information System - application in forestry; Computer software used in GIS; Analysis of soil for Gypsum and lime requirement; Exercises on study of eroded soils; Study on types of pits and trenches, tree species suitable for mined out areas; Visit to nearest mined areas.

03BSF 105 Forest Mensuration 3(2+1)

Introduction, definition, objectives and scope of forest mensuration. Scales of measurement (nominal, ordinal, interval and ratio scale). Units of measurement, standards of accuracy implied in their expression. Measurement of single tree - objectives, standard rules governing measurement at breast height. Measurement of tree diameter and girth using rulers, callipers and tapes. Comparison between tape and calliper measurements. Measurements of upper stem diameter and instruments such as Ruler, Finish Parabolic Calliper, Relaskop, Pentaprism. Bark measurements - objectives, thickness, surface area and volume. Crown measurements - objectives, diameter, height, surface area and volume. Height measurements - direct and indirect methods. Height measurement employing geometric and trigonometric principles, height measuring instruments, errors in height measurement. Measurement of cross sectional area, basal area, bole surface area, leaf area. The tree stem form, taper and classification of form factors and form quotient. Volume estimation of felled and standing trees and formulae involved. Volume tables-definition and their classification, (general, regional and local volume tables), merchantable volume tables. Preparation of volume tables. Stand growth, site quality, site index, stand structure, yield tables and preparation of yield tables. Biomass measurement. Determination of age of trees. Tree growth measurements, objectives increment, determination of increment, stump analysis, stem analysis and increment boring. Measuring tree crops - objectives, diameter, diameter and girth classes, height measurement of crop, crop age and crop volume. Stand tables. Forest inventory- definition, objectives, kinds of enumeration. Sampling - definition, advantages, kinds of sampling, random sampling: (simple, stratified, multistage and multiphase sampling). Non random sampling (selective, systematic and sequential sampling) sampling design, size and shape of the sampling units. Point sampling - horizontal and vertical point sampling. Introduction to remote sensing and its application in forestry.

Practical: Units of measurement and their uses. Instruments used in forest mensuration and their working principles, pertaining to tree height, diameter, basal area, bark thickness and crown measurements. Measurement of bark thickness, bark volume, bark area and crown parameters. Volume estimation of logs, felled trees and standing trees. Preparation of volume tables, volume estimation of forest stands. Stump analysis and increment boring. Determination of age of standing trees. Calculation of CAI and MAI. Sampling exercises including Point sampling. Calculation of crop diameter, crop height and crop volume. Estimation of form factor. Estimation of canopy density. Use of aerial photographs in forest inventory. Study of different satellite images and their application in forestry.

03 BSF106 Principles and methods of Tree Improvement 3 (2+1)

Introduction, history and development of tree improvement, its relation to other disciplines for forest management. Reproduction in forest trees - anthesis and pollination - their importance in tree breeding. Quantitative inheritance, heritability, genetic advance, genetic gain, combining ability and their application. Genetic, environmental and phenotypic expression of trees. Genetic basis of tree breeding and selection practices in forest trees. Patterns of environmental variation- species and provenance trials in forest trees. Seed stands (seed production areas) Plus tree selection, progeny trials and establishment of seed orchard. Genetic consequences of hybridization. Back cross breeding, heterosis breeding, breeding for resistance to insect pest, diseases, air pollution and for wood properties. Conservation of forest tree germplasm. Recent techniques in tree improvement. Vegetative propagation and tree improvement.

Practical: Floral biology & phonological observations in some important species. Estimation of pollen sterility and viability. Emasculation & hybridization in self pollinated species. Emasculation & hybridization in cross pollinated species. Different breeding methods-flow chart. Species and provenance selection techniques. Recording observation in provenance trial of some important species-recording variation & working out coefficient of variation. Sampling in seed collection. Recording stand density in seed stands, seed output; season of seed collection. Vegetative propagation techniques and tree improvement. Estimation of phenotypic and genotypic coefficient of variation. Estimation of genetic advance, heritability and GCA. Exercise in plus-tree selection. Seed orchard designs. Recording the design and observations in teak, Eucalyptus seed orchards. Genetic engineering techniques in tree improvement.

03BSF107 Tree Seed Technology 2(1+1)

Introduction - Seed and its importance - afforestation activity and seed requirements in India and HP. Role of seed technology in nursery stock production. Production of quality seed, identification of seed collection areas-seed orchards - maintenance of genetic purity-isolation and roguing, seed source provenance and stands. Selection of seed tree, genotypic and phenotypic selection, plus tree - pure stands, elite seed tree, isolated tree and their location. Locality factors. Seed Collection - Planning and Organization, Collection methods, Factors affecting seed collection, Seed maturity and tests. Seed processing - Seed extraction, drying, blending, cleaning, grading, treating, bagging, labeling and storage. Storage - orthodox and recalcitrant seeds, precautions of handling of recalcitrant seeds, natural longevity of tree seeds, factors affecting longevity - storage conditions, methods and containers. Seed testing, sampling, mixing and dividing, determination of genuineness, germination, moisture, purity, vigour, viability, seed dormancy and breaking of seed dormancy. Different viability and vigour tests, seed pelleting, seed health. Classes of tree seeds, certification procedures of tree seeds.

Practical: Identification of seeds of tree species; Seed maturity tests; Physical purity analysis; Determination of seed moisture; Seed germination test; Hydrogen peroxide test; Tetrazolium test for viability; Seed vigour and its measurements; Methods of breaking dormancy in tree seeds; Testing membrane permeability; Study of seed collection and equipments; 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.

03 BSF108 Tribology and Anthropology 2(2+0)

Anthropology - definitions, nature and scope of Anthropology. Branches of Anthropology & methods of anthropological study, Concepts of Culture, Society, Community, Groups and Institutions. Race - concept criteria of racial classification, major races of India and the world. Social Institutions: Family

- forms and functions, Marriage - forms and functions, Kinship - decent, residence, Systems terminology and usages, Tribal Economy, Tribal religion. Meaning, definitions and characteristics of Tribes. History of Indian Tribes. Tribal Demography. Tribal - Social and Political organization. Tribal Law and Justice. Tribal taboo and Totem. Socio-cultural and socio-economic problems of tribes with special reference to indebtedness, land alienation, shifting cultivation, migration, depopulation, un-employment, impact of urbanization and industrialization, education and forest problems. Social and cultural change - its meaning and characteristics and difference between social & cultural change and recent changes among the tribals. Forest and Tribes - their relationship-forest ecosystem and cottage industries. Role of Tribals in Forest protection, development & conservation. Tribal welfare and social forestry, Tribals and Co-operative movements. History of tribal welfare and administration - the Constitutional safeguards for the scheduled tribes. Policies, plans and programmes of tribal development and their implementations. The role of anthropology in tribal development.

03 BSF 109 Structural Grammar and Spoken English 2 (1+1)

Applied Grammar: 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. Words with Silent Letters and their Pronunciations. The Basic Intonation Patterns.

Practical: Exercises in Word Classes. Study of Verb Patterns. Use of Tenses and Voice. Exercises in the Use of Conjunctions and Prepositions. Exercises in Sentence Patterns. Writing Reports on Topics relating to Horticulture/Forestry, using Active and Passive Sentences. (i) Conversations related to Everyday Situations, (ii) Selection and Practice of Conversations for the Study of the Concept of Stress, Stress Shift, Silent Letters in Wordsand Basic Intonation Patterns.

IV. Semester.

Subject Code	Name of Subject	Teaching Periods		Credit Points
04BSF101	Livestock Management	1	1	2
04BSF102	Wood Science and Technology	2	1	3
04BSF103	Wood Products & Utilization	1	1	2
04BSF104	Silviculture of Indian Trees	2	1	3
04BSF105	Nursery Management & Commercial forestry	1	1	2
04BSF106	Fundamentals of Wild Life	2	0	2
04BSF107	Forest Pathology	2	1	3
04BSF108	Fundamental of Extension Education	1	1	2
01BSF301	DACA	0	1	1
Total		**12**	**8**	**20**

04BSF 101 Livestock Management 2(1+1)

Important breeds of cattle, buffalo, sheep and goat. Breeding and reproductive management for higher productivity - breeding systems, estrous cycle, heat detection and artificial insemination. Feeding management - types of feedstuffs available for feeding livestock. Feed nutrients and their functions in animal body. Assessing nutritive value of feed -estimation of feed nutrients by proximate and Van Soest methods, estimation of digestible nutrients and energy in feedstuffs. Principles of rationing. Milk - definition, composition and nutritive value. Factors affecting quantity and quality of milk. Prevention and control of diseases.

Practical: Different tools/instruments used in livestock management; Routine management practices followed on livestock farms; Identification of feedstuffs and their nutritive value; Nutritive requirement animals; Computation of rations for livestock; Study of housing systems and requirements; Study of dairy farm records; Analysis of milk for fat, acidity, total solids and specific gravity; Preservation of fodder as hay6, silalge and leaf meal.

04BSF 102 Wood Science and Technology 3 (2+1)

Wood as raw material, kinds of woods- hardwood, softwood; bamboos and canes. Merits and demerits of wood as raw material. The physical features of wood. Mechanical properties of wood like tension, compression, bending, shearing cleavage, hardness, impact resistance, nail and screw holding capacities. Suitability of wood for various uses based on mechanical and physical properties. Electrical and acoustic properties of wood. Wood water relationship -shrinkage, swelling, movement, fibre saturation, equilibrium moisture contact. Wood seasoning - merits, principles and types - air seasoning, kiln seasoning and chemicals seasoning. Refractory classes of timbers, kiln schedules. Seasoning defects and their control. Wood preservation - principles, processes, need, types of wood preservatives (Water soluble, oil based, etc.), Classification of timbers based on durability. General idea about fire retardants and their usage. Non-pressure methods - steeping, dipping, soaking open tank process, Boucherie process. Pressure methods - full cell process, empty cell process (Lowry and Rueping). Wood machining. Sawing - techniques, kinds of saws - cross cut, edging, cudless, hand, circular and bow saws. Wood working, tools used in wood working (parting, slicing, shaping, measuring and marking tools). Various stages in wood working. Dimensional stabilization of wood by surface coating method, bulking method, impregnation of resins and polymers.

Practical: Different kinds and types of wood available as raw material. Parts of logs, other wooden raw materials and preliminary idea regarding procurement and temporary storage. Preliminary idea regarding conversion and milling. Estimation of moisture content and density of wood by oven dry method and by moisture meters. Seasoning of timber, air seasoning, kiln seasoning etc. Seasoning defects and their remedies. Testing of mechanical properties of wood. Woodworking, tools used and various stages and types of joints in wooden members, wooden fasteners, dowels, carving, sanding etc. Polishing and finishing of wood. Surface coating applications and wood primers. Wood preservatives. Chemicals used and methods of wood preservation and fire retardant treatments.

04BSF 103 Wood Products and Utilization 2(1+1)

Pulp and paper industry. Introduction and raw material; pulping-mechanical, chemical, semi-chemical and semi-mechanical; pulp bleaching; stock preparation and sheet formation; types of paper; manufacture of rayon and other cellulose derived products. Manufacture, properties and uses of Composite wood- plywood, fiberboard, particleboard and hard board. Adhesives used in manufacture of composite wood. Improved wood-definition, types (impregnated wood, heat stabilized wood, compressed wood, and chemically modified wood). Destructive distillation of wood. Saccharification of wood. Production of wood molasses, alcohol and yeast.

Practical: Visit to paper industry to study pulp and papermaking. Study of different types of papers. Study of different types of paper boards. Visit to Rayon industry. Visit to plywood industry to study the manufacturing processes. Study of plywood, fiberboards, particleboards, and hard boards. Visit to other wood based industries. Visit to wood distillation unit. Visit to nearby industrial plantations. Study of types of improved wood.

04BSF 104 Silviculture of Indian Trees 3 (2+1)

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: *Abies pindrow, Picea smithiana, Cedrus deodara, Pinus roxburghii, Pinus wallichiana, P. gerardiana and Juniperus macropoda.* Broad leaved species: *Tectona grandis, Shorea robusta, Acacia* spp., *Dalbergia sissoo, D latifolia, Quercus* spp. *Robinia pseudoacacia, Alnus* spp. *Anogeissus spp. Populus* spp, *Eucalyptus* spp. *Casuarina equisetifolia, Terminalia* spp., *Santalum album, Swietenia mahagony, Albizzia spp, Prosopis* spp. *Pterocarpus santalinus, Azardirachta indica, Diospyros melanoxylon, Madhuca indica, Leucaena leucocephala and Bamboos.*

Practical: 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, *Dalbergia sisoo* and *Acacia catechu, etc.* Practicing thinning in Bamboo clumps. Study on tree responses to the abiotic and biotic factors viz., light, fire, drought, frost, root suckering, coppicing and pollarding, etc. To study quality characters of nursery planting stock.

04BSF 105 Nursery Management 2(1+1)

Propagation concept, definition, methods and importance. Site selection, planning and layout of nursery area. Types of nursery, types of nursery beds, preparation of beds. Pre-sowing treatments. Methods of seed sowing. pricking. watering methods, weeding, hoeing, fertilization, shading, root culturing techniques, lifting windows, grading, packaging. Storing and transportation. Type and size of containers. Merits and demerits of containerized nursery. Preparation of ingredient mixture. Vegetative propagation techniques - macro and micropropagation. Study of important nursery pests and diseases and their control measures. Nursery practices for some important tree species.

Practical: Preparation of production and planning schedule for bareroot and containerized nurseries. Nursery site and bed preparation. Pre-sowing treatments. Sowing methods of small, medium and large sized seeds. Pricking and transplanting of pricked out stock within nursery in transplant beds. Intermediate nursery management operations. Preparation of ingredient mixture. Filling of containers. Study of vegetative techniques - cutting, grafting etc. Visit to tissue culture laboratory and other nurseries.

04BSF 106 Fundamentals of Wildlife 2 (2+0)

Introduction : Definition of wildlife, free living, captive, domesticated and feral animals. Justification of wildlife conservation, uses, values and negative impact of wildlife. Zoogeographic regions and biomes of the world. India's uniqueness in biodiversity, reasons and causes of wildlife depletion. Biogeographic classification of India. Status and distribution of wildlife in India. Scientific and common names of important mammals, birds and reptiles. Rare, endangered and threatened species of mammals, birds and reptiles of India. Agencies involved in wildlife conservation, Govt. and NGO's. BNHS, WWF, Indian Board for wildlife, CITES. Biological basis of wildlife management. Basic requirements of wildlife -food, water, cover and space, limiting factors. Wildlife ecology : Relevance of basic ecological concepts such as foodchain, foodweb, ecological pyramids, habitat, ecological niche, carrying capacity, density, prey-predator relations and population dynamics.

04 BSF107 Forest Pathology 3 (2+1)

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, phytoplasma and phanerogames. Important characters of ascomycetes and basidiomycetes. Important orders and families of Hymenomycetes with a special reference to Aphyllophoraeae and Agaricaceae that contain members causing tree diseases. 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, *Dalbergia* sp., *Acacia* spp., neem, cassia, sal, *Albizia, Terminalia,* 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 of forest disease management. Definition and scope of disease management in forestry. Importance of disease cycle and economic threshold in disease management. Principles of disease management such as exclusion, cultural, chemical, biological and immunization. Nature of disease resistance. Fungicides and their use in nurseries and plantations. Integration of cultural, chemical, biological and host resistance in disease management, Meristem and tissue culture techniques in disease management. Nursery diseases of important forest species.

Practical: Study of microscope and micrometry; Collection, observation and preservation of diseased specimens and pathogenic structures; Morphological characters of fungi and bacteria; Morphological characters of viruses and phytoplasma; Preparation of culture media, isolation and subculturing of pathogens; Methods of inoculation and proving pathogenicity (Koch Postulates); Symptoms, signs and diagnosis of tree diseases; Measuring plant disease and methods of loss estimation; Symptoms, etiology and control of diseases/disorders of important tree species (sandal wood, teak and *Dalbergia);* Symptoms, etiology and control of disease/disorders of (eucalyptus, bamboo, cassia, semul and *Terminalia);* Symptoms, etiology and control of disease/disorders of important tree species (rubber, casuarina, neem and mango); Symptoms, etiology and control of disease/disorders of important tree species *(Albizia,* sal, sababul and *Acacia);* Symptoms, etiology and control of disease/disorders of important tree species (jack, *Lagerstroemia*, *Anogeissus* and *Emblica);* Fungicides, methods of their application and appliances used;

Mushroom cultivation; Assessment of seed-microflora of tree species; Use of bio-control agents and mycorrhizae in disease management; Tissue culture techniques in forest pathology; Visit to nurseries and plantation.

04BSF 108 Fundamentals of Extension Education 2(1+1)

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. Motivation of women community, children, youth and voluntary organizations for forestry extension work. Rural Development: meaning, definition, objectives and genesis. 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. Communication: meaning, definition, elements and selected models. Audio - visual aids: importance, classification and selection. Programming planning process - meaning, scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership.

Practical: Visits to study structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/Mahila Mandal, Village Panchayat, State Deptt. of

Forests/All India Radio (AIR). Exercises on distortion of message, script writing for farm broadcasts and telecasts, planning, preparation & use of NPVA like poster, chart, flash cards, folders etc. and AVA like OHP & 35 mm slide projector transparencies. Identification of local leaders to study their role in extension work. Evaluation of some selected case studies of forestry extension programmes. Preparation of Village Agricultural productions plan.

V. Semester.

Subject Code	Name of Subject	Teaching Periods		Credit Points
		L	P	
05 BSF 101	Elementary Statistics and Computer Application	2	1	3
05 BSF 102	Rangeland Management	2	1	3
05 BSF 103	Silvicultural Systems	2	0	2
05 BSF 104	Plantation Forestry	1	1	2
05 BSF 105	World Forestry Systems	2	0	2
05 BSF 106	Wildlife Management	2	1	3
05 BSF 107	Principles of Forest Economics, Project Planning and Evaluation	1	1	2
05 BSF 108	Environmental Science	2	1	3
01BSF301	DACA	0	1	1
		14	**7**	**21**

05 BSF101 Elementary Statistics and Computer Application 3(2+ 1)

Basic concepts: 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 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: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poison and normal distributions, sampling, basic concepts, sampling vs. complete enumeration parameter and statistic, sampling methods, simple random sampling and stratified random sampling. Tests of Significance: Basic concepts, tests for equality of means, and independent and paired t-tests, chi-square test for application of attributes and test for goodness of fit of mendalian ratios. Correlation: Scatter diagram, correlation co-efficient and its properties, regression, fitting of simple linear regression, test of significance of correlation and regression coefficient. Experimental Designs: Basic concepts, completely randomized design, randomized block design, latin square designs, factorial experiments, basic concepts, analysis of factorial experiments up to 3 factors - split plot design, strip plot design, long term experiments, plot size, guard rows. Computer application: Introduction to computers and personal computers, basic concepts, operating system, DOS and Windows 95, introduction to programming languages, BASIC language, concepts, basic and programming techniques, MS Office, Win Word, Excel, Power Point, introduction to Multi-Media and its application. VISUAL BASIC-concepts, basic and programming techniques, introduction to Internet.

Practical: Construction of frequency distribution table and its graphical representation, histogram, frequency polygon, frequency curve, bar chart, simple, multiple, component and percentage bar charts, pie chart, mean, mode for row and grouped data, percentiles, quadrille, and median for row and grouped data, coefficient of variation, 't' test for independent, will equal and unequal variants, paired 't' test, chi-square test for contingency tables and theoretical ratios, correlation and linear regression. Studies on computer components -

BASIC language, VISUAL BASIC, programming techniques, MS Office, Excel, Power Point.

05BSF 102 Rangeland Management 3 (2+1)

Introduction and definition. Relationship with other disciplines. History and development. Types and distribution around world. Grasses : characters and classification. Characteristics of rangelands: components of vegetation, nutrient value of forages and environmental factors. Importance of rangelands. Indian rangelands : origin, distribution, characteristics, status and management. Ecology in relation to grazing - Ecological concepts relevant in rangeland management, animal - plant interactions, effect on vegetation and plant succession. Plant morphology and physiology in relation to grazing factors - factors influencing food synthesis and reproduction. Range inventory - mapping, methods of sampling and evaluation, purposes and principles, Carrying capacity. Range utilization. Intensity and frequency of use. Range management - topography, animal species, forage preference, density. Grazing -grazing intensity, season of grazing, types - their merits and demerits. Animal unit (A.U.). Fire - controlled burning, effect of fire on vegetation and fauna. Weed control - types, their characteristics, chemical and biological control. Range improvement - range seeding, introduction of grasses and legumes, fertilization, soil and water conservation strategies. Multiple use.

Practical: 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; Indicators of heavy grazing; Studying plant preference by grazing animals; Grazing systems: simulations, indicators of heavy grazing.

05BSF 103 Silvicultural Systems 2(2+0)

Silvicultural system - definition, scope and classification. Even aged and uneven aged forests and their crown classes. Detailed study of the silvicultural systems: Clear felling systems including clear strip, alternate and progressive strip systems. Shelterwood system - Uniform system, Group system, Shelterwood strip system, Wedge system, Strip and group system, Irregular shelterwood system, Indian irregular shelterwood system. Seed tree method. Selection system and its modifications. Accessory systems. Coppice system - Simple coppice system, Coppice of the two rotation system,

Shelterwood coppice system, Coppice with standard system, Coppice-with-reserve, Coppice selection system, Pollard system. Conversion and its implications. Choice of silvicultural system. Dauerwald concept. Culm selection system in Bamboo. Tending operations - weeding, cleaning, thinnings, definitions, objectives and methods, increment felling and improvement felling. Prunning and lopping. Control of climbers and undesirable plants.

05BSF 104 Plantation Forestry 2(1+1)

Definition, scope and impediments. Plantation forests - planting plan, plantation records, maps. Plantation establishment -legal title of land, survey, site selection. Site preparation -purpose and methods. Planting - layout, time of planting, planting pattern, spacing, gap filling, planting methods, direct seedling. Choice of species on ecological aspects -afforestation of dry land, wet land, other adverse sites and taungya. Enrichment planting, nurse and cover crops. Intercultural operations. Plantation maintenance - weed control, climber cutting, staking, singling and pruning. Thinning - definition, objectives. Effects of thinning - physiological and mensurational. Effect of methods of thinning on stand development. Energy and industrial plantation - definition, scope, species, establishment, management and impact on environment. Plantation economics.

Practical: Study of tools, materials and operations for establishment of plantations. Site selection and site preparation. Exercises on planting and tending. Study of the special techniques for difficult sites. Exercises on protection of plantations. Exercise on plantation layout. Collection of data for survival and growth performance. Use of fertilizers, weedicides for plantation management.

05BSF 105 World Forestry Systems 2(2+0)

Geographical distribution of forests and their classification. Critical examination of the world forest sources, productivity potential and increment of world forests. 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. Forest development and economy - forest based industries of the world. Recent trends in forestry development in the world. International forestry organizations.

05BSF 106 Wild Life Management 3(2+1)

History of wildlife management and conservation in India; cultural background. Habitat management: Purposes, principles, practices and tools-fire, cutting, grazing. Habitat interspersion and edge effect. Provision of water, saltlicks and food. Zoning - core, buffer, tourism and multiple use in protected areas. Wildlife damage control : Mitigating human -wildlife conflict: fences, trenches, walls, lure crops, repellents, translocation and compensation. Captive wildlife : Zoos and safari parks. Captive breeding for conservation. Central Zoo Authority of India. Wildlife census : Purpose, techniques. Direct and indirect methods of population estimation. Sample and total counts, indices, encounter rates and densities. Wildlife (Protection) Act, 1972. Protected areas - Sanctuary, National Park and Biosphere Reserves. Special projects for wildlife conservation. Project Tiger and Musk Deer Project. Introduction and reintroduction of species. Wildlife corridors. MAB, Red Data Book, Category of threat, CITES. Conservation : Meaning, principles and strategies, in-situ and ex-situ conservation, conserving biodiversity. Politics-socioeconomics, role of education and extension.

Practical: Field/laboratory studies of distinct and characteristics morphological and other features of fishes, reptiles, birds and mammals. Identification and study of wildlife in a nearby zoo. Bird watching : Preparation of inventory of an area. Direct and indirect methods of studying food habits of different wildlife. Studying habitat management and manipulation techniques. Wildlife damage and control : Questionnaire survey.

05BSF 107 Principles of Forest Economics, Project Planning and Evaluation 2(1+1)

Nature and scope of forest economics, importance of forestry in economic development. Concepts of demand, derived demand and supply with special reference forestry outputs. Basics of marginal analysis and its applications in economic analysis of forestry production systems. Basics of Linear Programming. Financial and economic rotations. Fundamentals of project planning and evaluation and network scheduling techniques. Valuation of timber and non-timber forest products.

Practical: Exercises on demand and supply, production functions, price analysis, benefit-cost ratio and other measures of financial feasibility, CPM and PERT approaches.

05BSF 108 Environmental Science 3 (2+1)

Environment: introduction, definition and importance. Components of environment -interactions with organisms. Global and Indian environment - past and present status. Environmental pollution and pollutants. Air, water, food, soil, noise pollution - sources, causes and types. Smog, acid rain, global warming, ozone hole, eutrophication, sewage amd hazardpis waste management. Impact of different pollutions on humans, organisms and environment. Introduction to biological magnification of toxins. Deforestation - forms and causes, relation to environment. Prevention and control of pollution - technological and sociological measures and solutions - Indian and global efforts. India, international and voluntary agencies for environmental conservation - mandates and activities. International conferences, conventions and summits - major achievements. Environmental policy and legislation in India. Introduction to environmental impact assessment. Causes of environmental degradation - socio-economic factors. Human population growth and lifestyle.

Practical: Visit to local areas - river/forest/Horticulture farm/ grassland/catchment etc. to document components of ecosystem. Study of common plants, insects, birds and animals. Visit to industries to study pollution abatement techniques.

VI. Semester.

Subject Code	Name of Subject	Teaching Periods		Credit Points
		L	P	
06BSF101	Forest Management, Policy and Legislation	2	1	3
06BSF102	Utilization of Non-timber Forest Products	2	1	3
06BSF103	Agroforestry Systems and Management	2	1	3
06BSF104	Medicinal and Aromatic Plants	2	1	3
06BSF105	Forest Entomology	2	1	3
06BSF106	Entrepreneurship Development and Communication Skills	2	1	3
06BSF107	Marketing and Trade of Forest Produce	2	1	3
01BSF301	DACA	0	1	1
Total		**14**	**8**	**22**

06BSF 101 Forest Management, Policy and Legislation 3 (2+1)

Introduction: definition and scope. Peculiarities of forest management. Principles of forest management and their applications. Objects of management, purpose and policy. Sustained and progressive yield concept and meaning. General definitions - management and administrative units, felling cycle, cutting section. Rotations: definition, kinds of rotations, choice of rotations, length of rotations and conversion period. Normal forest: definition and concept. Evenaged and unevenaged models. Estimation of growing stock, density, quantity and increment. Yield regulation - general principles of even aged and unevenaged forest crop. Yield regulation based on area, volume, area and volume, increment and number of trees. Working Plan - definition, objects and necessity. Forest Policy: definition, necessity and scope. Legal and institutional approaches to forest resource management. National Forest Policies. Forest Law: legal definition. Objects of special forest law. Indian Forest Act. Detailed study of IFA, 1927. Himachal Pradesh State Forest Acts and Rules.

Practical: Visit to plantations of different age gradations, record the actual growing stock and workout increments. Visit to forests and enumerate the stock and test one of the method for yield regulation. Study the various units adopted in the forest management. Study of various records and forms maintained in the office of the RFO with regard to management of forests under their control. Study of procedure for seizure of property. Visit to forest department and courts to observe penalty procedures. Preparation of first information report and enactment report. Study of working plans of the forests and to prepare the working plan for one of the area in the **range.**

06BSF 102 Utilization of Non-Timber Forest Products 3(2+1)

Introduction, methods of collection, management and importance of Non-Timber Forest Products (NTFP). 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.

Practical: 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. Study of non-essential oils and their sources. Study of gums and resins and their collection. 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.

06BSF103 Agroforestry System and Management 3(2+1)

Indian agriculture - its structure and constrants. Land use definition, classification and planning. Agroforestry - definition, aims, objectives and need. Traditional agroforestry systems: Taungya system,Shifting cultivation, wind break, shelterbelts, Homestead gardens'. Alley cropping, high density short rotation plantation systems, silvicultural woodlots/energy plantations. Classification of agroforestry system -structural, functional, socio-economic and ecological basis. Multipurpose tree species and their characteristics. Tree architecture, canopy management - lopping, prunning, pollarding and hedging. Diagnosis and design. Agroforestry systems in different agroclimatic zones, components, production and management techniques. Nutrient cycling, soil conservation, watershed management and climate change mitigation. Economics of agroforestry systems. People participation, rural entrepreneurship through agroforestry and industrial linkages. Analysis of fodder and fuel characteristics of tree/shrubs. Financial and socio-economic analysis of agroforestry systems.

Practical: Study characteristics of trees/shrubs/grasses for agroforestry. Volume and biomass estimation. Crown measurement, light interception and moisture measurement in agroforestry systems. Annual crops/grass growth measurements and yield estimation. Analysis of soil and plant

samples for organic carbon N,P and K. Diagnosis and design - methodology. Survey agroforestry practices in local/ adjoining areas.

06BSF104 Medicinal and Aromatic Plants 3 (2+1)

History, scope, opportunities and constraints in the cultivation and utilisation of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and aftercare, training and pruning, nutritional and water requirements. Plant protection, harvesting, processing and economics of under mentioned important medicinal and aromatic plants. Medicinal Plants : pepper, cardamom, clove, ginger, turmeric, betelvine, periwinkle, *Rauvolfia, Dioscorea*, isabgol, *Ammi majus*, belladonna, *Cinchona*, pyrethrum and other species relevant to local conditions. Aromatic Plants : Citronella grass, khus grass, sweet flag (bach), lavender, geranium, patchouli, bursera, *Mentha*, muskdana (musk mallow), *Ocimum* and other species relevant to the local conditions. Endangered medicinal and aromatic plants of India and their conservation. Study of chemical composition of a few important medicinal and aromatic plants, their extraction and use. Therapeutic and pharmaceutical uses of important species.

Practical: Morphological description and identification of various medicinal plants. Collection of medicinal plants and plant parts from natural habitats. Survey and study of nursery techniques including training and pruning of medicinal plants. Harvesting, drying, grading, storage and processing techniques. Study of plant parts used in drug making. Visit to a nearby medicinal and aromatic plantation area /nursery /ayurvedic pharmacies /pharmaceutical industries.

06BSF 105 Forest Entomology 3(2+1)

Definition, importance and scope of Entomology. Definition of insect and its position in the Animal Kingdom. Important characters of phylum arthropoda and class insecta. External morphology of generalized insect. Insect growth and development, Reproduction in insects, immature stages (Egg. Larvae/Nymph and Pupae); metamorphosis in Insects Taxonomic classification of class Insecta, diagnostic characters of the orders and major families of economic importance. History and importance of Forest Entomology in India. Methods and principles of pest control: Mechanical, physical, silvicultural, legal, biological and chemical. Principles and techniques of Integrated Pest Management in forests. Classification of forest pests : types of damages and symptoms; factors for outbreak of pests. Nature of damage and management: Insect pests of forest seeds, forest nursery and standing trees of timber yielding species of natural forest (Tectona, Dalbergia sp., Sal, Albizia spp., Sandal, Ailanthus, Gmelina, Terminalia, Deodar, Pines); Plantation forest species (Eucalyptus, Bamboo, Casuarina, Neem, Acacia) Fruit trees (Emblica, Ber, Eugenia, Tamarind). Insect pests of freshly felled trees, finished timbers and their management. Morphology of plant parasitic nematodes, brief classification of important genera of nematodes. Important diseases caused by different genera and their management practices.

Practical: Study of distinguishing characters of phylum Arthropoda; Study of morphology, mouthparts and appendages of cockroach; Study of different types of insects; Study of immature stages of insects; Study of Anatomy of cockroach; Study of Insect collection, pinning, labelling and preservation; Study of representatives of insect orders and families; Study of predators and parasites; Study of insecticides and their formulations, plant protection appliances; Study of insect pests of forest seeds; Study of insect pests of forest nurseries; Study of insect pests of standing trees, freshly felled trees and finished products; Study of morphological characters of nematodes; Extraction of plant parasitic nematodes; Important symptoms of plant parasitic nematodes; Visit to forest nurseries and plantations.

06BSF106 Entrepreneurship Development and Communication Skills 2 (1+1)

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and

follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to forestry sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of forestry inputs industry. Characteristics of Indian forestry processing and export industry. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical: Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations.

06BSF107 Marketing and Trade of Forest Produce 3(2+1)

Nature and scope of marketing. Approaches to marketing and the study of marketing functions with special reference to forestry. Classification of market, market structure and conduct of important timber and non-timber markets. Marketing channels, costs, margins and price spread - concepts and applications. Concepts of market integration and marketing efficiency. Role of public and private agencies in marketing of forest produce. Market inefficiencies in the trade of forest produce and measures to check the same. Fundamentals of international trade. Domestic and international trade in timber and non-timber forestry outputs. Demand forecasts - concept and methods. WTO - background, structure, functions and decision making process. IPRs and their implications for forestry and allied sectors in the country.

Practical: Library review of studies on marketing, visits to local timber and non-timber markets; collection and analysis of price and quantity data for various forest products; study of marketing channels and price spread for important timber and non-timber forestry products.

Semester VII and VIII

Forestry Work Experience: Total duration of the programme should be 20 weeks and shall be conducted in VII semester (or VIII semester depending on regional suitability). First 4 weeks of the programme shall focus on village attachment and shall be followed by 10 weeks of intensive attachment with State Forest Departments. For 4 weeks students shall be placed in forest based industries for hands-on training. In the concluding 2 weeks the students shall be preparing a complete project report and give an oral presentation. The details of the course are as follows:

Paper code	Course Title	T	P	Credits	Days
07BSF101	Forestry Work Experience-(Socio-economic surveys - village attachment)	0	4	4(0+4)	28
07BSF102	Attachment with State Forest Department for Forestry operations	0	10	10(0+10)	70
07BSF103	Industrial Placement	0	4	4(0+4)	28
07BSF104	Report Writing and Presentation	0	2	2(0+2)	14
07BSF301	DACA	0	1	1(0+1)	
	Total	**0**	**21**	**21(0+21)**	**140**

Socio-economic surveys -village attachment (0 + 4)

- Data collection with respect to village profile in respect of socio-economic and Cultural status, farm technology used etc.
- Bench Mark Survey of plant resources (cropping pattern, yield system etc.)
- Schedule development, tabulation, analysis and preparing plan of work.
- Understanding local forestry and other village level institutions (panchayat, Village Forest Committees, corporations, youth/women groups etc.)
- People's participation in developmental programmes with special reference to forestry.
- Exercises on the use of extension methods and teaching aids for Transfer of Technology.

Attachment with Forest Department for Forestry Operations (0 +10)

- Visit to modern forest nurseries, herbal gardens and watersheds
- Study the felling and logging operations, timber lots and important industrial products
- Study working plan, enumeration, volume and yield calculation & compartment history files
- Study the 'CAT' (Catchment Area Treatment Plan) and FDA (Forest Development Agencies)
- Use of forestry equipments/instruments
- Study the regeneration and management of important forestry tree species.
- Sample plots, layout studies, stump analysis, preparation of local volume Tables.

Industrial Placement (0 + 4) Attachment with Forest Based Industries like:

- Wood Workshop and Saw Mills
- Wood Seasoning and Preservation Treatment Plants
- Pulp and Paper Industries
- Katha Making Industry
- Rosin and Terpentine Industry
- Aromatic and Medicinal Plant Units
- Carpentry and bamboo crafts
- Other Wood Products Industries

Works to be undertaken

- Study the Nature of Industrial and Business Organization - Structure
- Raw-material - Collection and Processing of Raw-material
- Production and Management Process
- Marketing and Financial Management

Report writing and presentation (0+2)

- Compilation of the work/experience detailing the objectives, places and persons visited, work done, experiences / skills gained.
- Presentation of the report before faculty/Committee.

One academic staff member of the college will co-ordinate and monitor the entire programme. Each student or a batch of students shall be sent to a village, Division of the State Forest Department, industry. The evaluation of the programme shall be done by the host industry /State Forest Department (50%) and rest by Committee constituted by the Dean. The assessment will be based on Project Report evaluation and viva-voce.

Hands on Training/Experiential Learning: Areas of specialization for "Hands-on training" should be decided by each college/University as detailed below depending upon local needs and industrial demand. It is expected that the students will prepare a work plan for the relevant area of specialization. An end-to-end approach is to be followed in implementing the programme. While identifying the area of specialization, the college shall take into account the faculty and infrastructure facilities available and their regional significance. All the students shall have an Advisor, who will guide the students in "Hands-on Training". A total of 20 credits are allotted for "Hands-on Training" and the evaluation of the same shall be done by the Committee appointed by the Dean of the respective college.

VIII Semester:

(Experimental Learning/Hands on Training)

Three Supplementary Subjects **(Any one as an Optional)**

Subject Code	Course title	T	P	credit
08BSF101	Production and Marketing of Quality Planting Material	**0**	**20**	**20(0+20)**
08BSF102	Cultivation and Processing of Medicinal Plants	0	**20**	**20(0+20)**
08BSF103	Natural Resource Management	0	**20**	**20(0+20)**
08BSF301	DACA	0	**1**	**1(0+1)**
Total		**0**	**21**	**21(0+21)**

Multidisciplinary Courses

I. Production and Marketing of Quality Planting Material (0+22)

Activity	Weeks	Credit
• Project Development Identification of species (grasses, trees, medicinal plants & wild fruits) for nursery raising, time of collection of plant material from selected seed sources, quantity of seed/plant material required, nursery area (open and protected), inputs required, Schedule for intercultural operation- seed treatment, sowing, weeding, fertigation, root hardening treatments. Assessment of demand in local/potential markets and institutions. Physical Needs: i. Number of tree species - 3-5 ii. Minimum planting stock production - 5000seedlings/species iii. Grasses - 0.25ha land area iv. Protected area - 50-100 sq m	2	0+2
• Collection, Handling, Processing and Storage of planting material: Identification of superior seed sources, seed collection, treatment and Storage	3	0+2
• Vegetative Propagation under controlled and ambient conditions Collection of vegetative propagules, treatment and its processing of bare	3	0+3

root and containerised seedlings		
• Nursery Management Raising, seed bed preparation, raising of polyhouse, sowing, planting and other inter-cultural operations	11	0+9
• Marketing of seeds and seedlings; grading of quality stock and pricing	2	0+2
• Cost Benefit analysis, Project Report & Presentation	1	0+2

II. Cultivation and Processing of Medicinal Plants (0+22)

Activity	Weeks	Credit
Market Survey & Prioritization of species: Visit to marketing centers in the region, assessment of demand and trade in specific species suitable for cultivation in the respective regions; exploring possibilities of buy back and linkages with industries.	2	0+2
Project proposal development: Defining objectives, cultivation and processing methodology to be adopted, advisement needed, necessary support required and expected outcome.	1	0+1
Raising of selected crop/s (at least two crops in 500 sq m for each crop): The activities includes all necessary cultural practices for nursery raising, transplantation, hoeing, weeding, irrigation, fertigation, plant protection measures etc.	14	0+9
Harvesting and post-harvest management: The activities includes harvesting at optimum stage, drying, garbling, grading, packing and storage.	2	0+4
Primary processing and value addition: The activity involves exposure of the student to basic chemical extraction processes, distillation of essential oils, preparation of powders, tinctures, extractives etc.	3	0+2
Marketing of produce, project report and presentation	2	0+2

III. Natural Resource Management (0+22

Activity	Weeks	Credit
1. Resource Survey and Evaluation Operational area and land use - 100-250 ha micro watershed Soil, Water, Vegetation, Livestock Resources Soil Erosion - types and extent, land degradation Wastelands - types and extent Climatic parameters Socio-economic parameters- constraints, need and potentials	3	0+4
2. Preparation of Resource Maps using GIS and Remote Sensing GIS and Remote Sensing applications Feeding of data collected from survey and preparation of maps, inventories and reports Attachment: State/University, GIS and Remote Sensing Centres (GIS and Remote Sensing facilities to be developed at SAUs, if not available).	8	0+5
3. Preparation of Micro-Plans for efficient use of Natural Resources Soil, Water, Vegetation and others. (The Plan will be prepared on integrated micro-watershed basis for the development and their efficient utilization)	3	0+3
4. Resource Conservation and Production Technologies Resource Conservation •Operational area •micro-watershed including arable, non-arable and waste lands conservation •Vegetative measures: Grasses, Shrubs and Trees and their combinations •Structural designs including principles and practices: erosion control measuressuch as check dams, spurs, Gabion structures •Water conservation: ground water recharging, in-situ water conservation and vegetative and mechanical barriers •Land shaping, trenching, bunding and terracing and mulching •Percolation Structures Production • Agroforestry and Avenue plantations including wind breaks, shelterbelts etc.) • Agronomical practices: land use (horticulture, forestry, agriculture)	4	0+3
5.Case Studies Environment Impact Assessment (EIA) and Strategic Environment Appraisal (SEA) in specific problematic sites or Disaster Management: Forest fire, floods/ droughts/ landslides and slips/ avalanches/storms/tsunami. or Watershed Management	4	0+3
6. Project Report & Presentation	1	0+2