

## **B.Sc(Hons) Forestry**

India is a land of forests and agriculture and for many decades country's major occupation lacked specialized and modern techniques. This necessity originates the need of the innovative attitude. The various courses in Forestry are designed to help student understand the modules of forestry, the environment etc. Moreover the course is designed in such a way that the student would also get knowledge about the management, conservation and expansion of the forests as it is the need of the hour not only from resource point of view but also from the point of view of environment. The objective of the program is to educate future forest and environment students who have general knowledge and skills in forests management and environment protection process. After the completion of the course the students would be able to plan, manage and develop forest resources for multiple benefits according to ecological and socio-economic demands

Eligibility Criteria: 10+2 in Science or equivalent in any stream

To earn a B.Sc (Forestry), a student has to earn a minimum of 120 credits. Min 60 credits to be earned from general science subjects, Min 30 credits from Forestry subjects and remaining can be taken from any stream

Every student has to attain a minimum of D grade in all courses; a student may however, and repeat or change any course being offered. Notwithstanding, every student must acquire the desired number of credits. The detailed course structure under different categories is given in succeeding pages. Brief description of the course content follows thereafter.

<b>Codes</b>	<b>Subject Name</b>	<b>Credit</b>
13.101	Principles And Practices of Silviculture	4
13.102	Forest Ecology, Biodiversity & Conservation	4
13.103	Cytology And Genetics	4
13.104	General Biochemistry	4
13.105	Introduction To Tree Science	4
13.106	Computer Applications	4
13.107	Forest Mensuration	4
13.108	Environmental Studies - I	4
13.109	Introduction To Forest Soil Science & Geology	4
13.110	Dendrology	4
13.111	Principles Of Forest Economics	4
13.201	Surveying And Leveling	4
13.202	Tree Seed Technology	4
13.203	Agrometeorology	4
13.204	Fundamentals of Extension Education & Community Development	4
13.205	Forest Management And Working Plan	4
13.206	Silvicultural Systems	4
13.207	Forest Entomology And Pest Management	4
13.208	Livestock Management	4
13.209	Fertility of Forest Soils And Nutrient Management	4
13.210	General And Forest Microbiology	4
13.211	Medicinal And Aromatic Plants	4
13.301	Environmental Studies - II	4
13.302	Wood Anatomy	4
13.303	Agroforestry & Social Forestry	4
13.304	Silviculture Of Indian Trees	4
13.305	Fundamentals Of Wildlife & Forest Tribes	4
13.306	Wood Science & Technology	4
13.307	Forest Soil Survey, Land Use & Remote Sensing	4
13.308	Nursery Management And Seedling Production	4
13.309	Forest Utilization	4
13.310	Wildlife Management & Biosphere	4
13.345	Project	4

### **13.101 PRINCIPLES AND PRACTICES OF SILVICULTURE**

Credit 4

**Content:** 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 evapotranspiration in relation to forest vegetation. Bioclimatic 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.

### **13.102 FOREST ECOLOGY, BIODIVERSITY & CONSERVATION**

Credit 4

**Content:** 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 succession, 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.

### **13.105 CYTOLOGY AND GENETICS**

Credit 4

**Content:** 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 inheritance, pleiotropy, threshold characters, co-dominance entrance. 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

### **13.104 GENERAL BIOCHEMISTRY**

Credit 4

**Content:** 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 oils acids value, saponification value & iodine value – phospholipid 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.

### **13.105 INTRODUCTION TO TREE SCIENCE**

Credit 4

**Content:** Introduction to trees and their general classification under different forest types. Important tree families and their peculiar characters. Patterns and Parts of typical flowering trees. Morphology of flowers. Structure and types of trees. Difference between the trees and other plant community. Types of trees and canopy structure. Growth-pattern of trees; seedling, saplings, trees, bole and pole stages. Branching patterns of trees. Change in tree morphology with respect to climatic, edaphic and topographic factors. Coniferous and broad leaved tree species. Trees in tropical, sub-tropical, temperate and alpine regions. Significance of tree in human life- tangible and intangible benefits. Identification of different tree species. Important uses of trees.

### **13.106 COMPUTER APPLICATIONS**

Credit 4

**Content:** Computer application: Introduction to computers and personal computers, basic concepts, operating system, DOS and Windows, 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. Information management, such as data storage/retrieval, data validation, security of data, data manipulation, presentation of data and report generation – Introduction to commonly used software application packages – Familiarization with commonly used application packages like RDBMS, MS-Office, Word Processing etc.

### **13.107 FOREST MENSURATION**

Credit 4

**Content:** 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.

### **13.108 ENVIRONMENTAL STUDIES – I**

Credit 4

**Content:** The multidisciplinary nature of environmental studies: Definition, scope and importance- Need for public awareness- Ecosystems-Concept of an ecosystem-?Structure and function of an ecosystem-Producers, consumers and decomposers-Energy flow in the ecosystem- Ecological succession-Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the various ecosystems.

### **13.109 INTRODUCTION TO FOREST SOIL SCIENCE & GEOLOGY**

Credit 4

**Content:** 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 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<sub>2</sub> 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.

### **13.110 DENDROLOGY**

Credit 4

**Content:** 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. Morphology 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.

### **13.111 PRINCIPLES OF FOREST ECONOMICS**

Credit 4

**Content:** 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. Economics as social science – Forest Economics - Definitions and concepts – Nature and scope of Forest economics - Divisions of Forest economics – Approaches to the study of Forest economics – Forest Economics Vs Agricultural Economics. Consumption – theory of consumer.

### **13.201 SURVEYING AND LEVELING**

Credit 4

**Content:** Surveying: Introduction, classification and basic principles, Linear measurements. Chain surveying. Compass survey. Errors in measurements, their elimination and correction. Plane table surveying. Levelling, Contouring, Computation of area and volume. Theodolite traversing. Introduction to setting of curves.

### **13.202 TREE SEED TECHNOLOGY**

Credit 4

**Content:** Introduction – Seed and its importance – afforestation activity and seed requirements in India and UP. Role of seed technology in nursery stock production. Production of quality seed, identification of seed collection areas-seed orchards – Location and maintenance of seed orchards-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.

### **13.203 AGROMETEOROLOGY**

Credit 4

**Content:** Agro meteorology-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 Uttar Pradesh. Evaporation and transpiration. Use of remote sensing techniques in agrometeorology. Agriculture weather forecasting.

### **13.204 FUNDAMENTALS OF EXTENSION EDUCATION & COMMUNITY DEVELOPMENT**

Credit 4

**Content:** Extension Education : 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).

### **13.205 FOREST MANAGEMENT AND WORKING PLAN**

Credit 4

**Content:** 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. Normal age gradation in regular and irregular forests – felling series in selection forest and coppice with standard system – Increment - CAI –MAI – relationship. Growing stock – concept and definition –determination of growing stock – Normal growing stock in regular, shelter wood system, selection system. Joint forest management \_ concept and methodology – successful citations for Indian Scenario

### **13.206 SILVICULTURAL SYSTEMS**

Credit 4

**Content:** 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. Pruning and lopping. Control of climbers and undesirable plants.

### **13.207 FOREST ENTOMOLOGY AND PEST MANAGEMENT**

Credit 4

**Content:** 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

### **13.208 LIVESTOCK MANAGEMENT**

Credit 4

**Content:** 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.

### **13.209 FERTILITY OF FOREST SOILS AND NUTRIENT MANAGEMENT**

Credit 4

**Content:** Forest soils – genesis – soil forming processes – podsolisation and laterization – genetic soil groups of the world – upland podzol – good soils – melanized – laterite and lateritic, hydromorphic and embryonic soils – clayey and organic soils – nutrients – nutrient retention and distribution – diagnosis and correction of nutrient deficiencies. Fertilizers - manures – classification – macro, secondary and micronutrient fertilizers – reactions – method of application – recovery and residual effect of added fertilizers – efficient use of fertilizers- organic, inorganic and biofertilizers – integrated nutrient management (INM). Soil fertility evaluation – approaches, concepts, and application. Effect of forest fire on soil properties – physical, chemical and biological – management practices.

### **13.210 GENERAL AND FOREST MICROBIOLOGY**

Credit 4

**Content:** Definition and scope of microbiology – spontaneous generation theory contributions of Antonie Van Leeuwenhoek, Louis, Pasteur John Tyndall , Robert Koch Joseph Lister, Winogradsky, Beijerinck, Fleming, Waksman and Frank Branches of microbiology. History of Forest Microbiology – scope and signification of Forest Microbiology - Microbiology - resolving power – numerical aperture, magnification – different types of microbiology and micrometry. Structure and organization of microbial cell : Prokaryotes and Eukaryotes, Various groups of microorganisms – bacteria , Fungi actinomycetes, algae, protozoa and virus. Methods of isolation and purification . Types of nutritional media – sterilization – principles of staining microorganisms. Preservation of microbial cultures. Nutritional types: autotroph, heterotroph, phototroph and chemolithotrophs. Requirements for growth- Temperature, pH and other factors.



### **13.211 MEDICINAL AND AROMATIC PLANTS**

Credit 4

**Content:** 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, Rauwolfia, 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

### **13.301 ENVIRONMENTAL STUDIES – II**

Credit 4

**Content:** Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. (e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources.

### **13.302 WOOD ANATOMY**

Credit 4

**Content:** 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, barksapwood, 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).

### **13.303 AGROFORESTRY & SOCIAL FORESTRY**

Credit 4

**Content:** Indian agriculture its structure and constraints. 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, pruning, 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.

### **13.304 SILVICULTURE OF INDIAN TREES**

Credit 4

**Content:** Origin, distribution, general description, phenology, silvicultural characters, regeneration methods, silvicultural systems and economic importance of the conifer and broadleaved tree species of India.

### **13.305 FUNDAMENTALS OF WILDLIFE & FOREST TRIBES**

Credit 4

**Content:** 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.

### **13.306 WOOD SCIENCE & TECHNOLOGY**

Credit 4

**Content:** 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 content. 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.

### **13.307 FOREST SOIL SURVEY, LAND USE & REMOTE SENSING**

Credit 4

**Content:** Scope and objective; soil survey, sampling methods; planning, inventory, permanent sample plots; sample size allocation, land use 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, stereo scopes, computers, radars. Photo grammetry: Vertical and oblique photography. Photographs and images, scales, resolution, photo interpretation, Photo grammetry, 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.

### **13.308 NURSERY MANAGEMENT AND SEEDLING PRODUCTION**

Credit 4

**Content:** 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 micro propagation. Study of important nursery pests and diseases and their control measures. Nursery practices for some important tree species.

### **13.309 FOREST UTILIZATION**

Credit 4

**Content:** Pulp and paper industry. Introduction and raw material; pulping-mechanical, chemical, semichemical 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. Techno – economic status and suitability of Indian timbers for various purposes Timber Grading – Scope and purpose of grading – Present systems of grading – practices in measurements and calculation in India.

### **13.310 WILDLIFE MANAGEMENT & BIOSPHERE**

Credit 4

**Content:** History of wildlife management and conservation in India; cultural background. Habitat management: Purposes, principles, practices and tools-fire, cutting,

grazing. Habitat interspersions and edge effects. 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.

### **13.345 PROJECT**

Credit 4