

**Following courses are approved under Paper-3: Advance area of research in the subject Forestry and Biodiversity for Ph.D programme:**

### **FRBD101E: Biodiversity and biotechnology (Credit-4)**

Biodiversity- definition, levels and types; latitudinal and altitudinal gradients of biodiversity; biodiversity and extinctions; biodiversity conservation strategies. Global approaches to biodiversity conservation: Climate change and biodiversity; international programmes for biodiversity conservation. Biodiversity of Indian subcontinent: Indian initiatives in biodiversity conservation-biodiversity act 2002, national biodiversity strategy and action plan (NBSAP), national biodiversity authority (NBA); biodiversity hotspots, their characteristic flora and fauna; Environment and Development Policies: Land and Agricultural Policies; Forest Policies in India

Biodiversity resources of north-east India: Plant and microbial diversity of north east India; threatened vascular plant species in India; biological invasions; Indigenous approaches to biodiversity conservation. Environmental amelioration – concept and challenges. Integration of environmental conservation strategies and economic development. Forestry interventions viz. Plantation forestry, industrial forestry, urban forestry, fuel wood/energy forestry including biofuels, short rotation forestry, Agroforestry, biodiversity parks, Sanctuaries and national parks and catchment plantations. Impact of soil moisture regimes, fertility improvements, poverty alleviation, micro-environment native biodiversity and overall environmental sustainability. Afforestation programmes and forest conflicts, wildlife and human conflicts, important forest movements; forests and food security, eco-tourism and local development, land use change and forestry; Forest rights, customary rights of people, community Participation, biodiversity and ethno botany.

Genetic diversity- concept, analysis of karyotype variation, genetic erosion, Techniques to assess genetic diversity- Molecular approaches to assessing genetic diversity, Inventory and monitoring biodiversity, Sampling strategies for genetic diversity assessment, sufficiency of sampling procedures, Neutral allele model and optional allocation of sampling efforts. Effects of sampling on genetics diversity, Factor influencing levels of genetic diversity in woody plant species. Conservation of genetic diversity. Global and local limitation for biodiversity conservation. Introduction to nucleic acids-DNA and RNA as molecules of life, discovery, structural elucidation and functions of DNA, nucleotides and nucleosides; synthesis, transcription and translation of DNA; molecular maps and markers- RAPD, RFLP, AFLP, STS, microsatellites, SCAR, SSCP, SNPs, QTL, ITS, etc.; chloroplast, mitochondrial and plasmid DNA-structure and functions; PCR, gel electrophoresis, blotting techniques, SDS PAGE, DGGE/TGGE, genome sequencing-protein and nucleotides.

Principles and requirements of plant tissue culture-cellular totipotency, callus and multiple shoot induction, micropropagation, protoplast isolation and fusion, cybrids, somaclonal variation, single and suspension cell cultures, somatic embryogenesis and PLBs; meristem culture and virus free plants, haploid production, embryo rescue, artificial seed production and cryopreservation. Principles, tools & techniques in cloning and plant genetic engineering/recombined DNA technology-vector and enzyme mediated transfer of plant genes, structure and function of Ti and Ri plasmids, reporter genes; direct gene transfer-electroporation, particle bombardment, biolistic gun; genetically modified forest crops-application in improving yield and quality, Nif gene in legume and non-legumes, stress tolerance, herbicide & disease resistance in forest crops.

### **FRBD102E: Forest Biology & Tree Physiology(Credit-4)**

#### **Plant Nutrients**

Mineral nutrients- absorption, translocation and utilization of mineral salts, Nitrogen metabolism, Water relation, Transport and translocation of water and solute, Salt and drought tolerance physiology in relation to production of biomass. Transpiration and osmo-regulation in relation to stress physiology.

#### **Plant biochemistry and metabolism**

Photosynthesis: Carbon partitioning, light reactions. General concepts. Organization of light-absorbing Mechanisms of electron transport. The carbon reactions. The Calvin-Benson cycle. Inorganic carbon-concentrating mechanisms: the C<sub>3</sub>, C<sub>4</sub> and CAM carbon cycle. The impact of environmental conditions on photosynthesis. Overview of plant respiration. Glycolysis. The citric acid cycle. The oxidative pentose phosphate pathway, mitochondrial electron transport and ATP synthesis. Respiration in intact plants and tissues. Photorespiration.

#### **Growth, development and differentiation**

Study of tree structure, growth, development and function, how these are related to the environment and to cultural practices, Factors affecting growth of trees, Phytohormones- Auxins, Gibberellins, Cytokinins, Ethylene, Absciscic Acid, Phytochrome; their mechanism of action, Role of growth hormones in vegetative propagation. Signaling and integration: auxin and GA, Biosynthesis and elicitors: ethylene and ABA

#### **Reproductive Physiology**

Physiology of flowering, Pollen Biology, Regulation of sexuality, photoperiodism in trees relating to the growth and regeneration, Vernalisation, Physiology of Embryo growth, Fruit Development and Ripening, Seed physiology – Germination and seed dormancy, The mechanism and regulation of seed dormancy and germination, molecular dissection of seed quality, The biophysical basis of seed longevity Bud dormancy, Abscission and senescence.

### **FRBD103E: Silviculture (Credit-4)**

Philosophy of silviculture – Advance reproduction methods and their role in Silviculture, Advance silvicultural practices in rain forest; Tropical forest; Subtropical forest, Temperate forest; Mechanization and role in Silviculture, Analysis of different techniques of silviculture in forest

Ecosystem Process: Maintenance of Energy flux, dissipation, climate modulation. Maintenance of hydrologic cycle, water quality. Biological productivity, plant pollination. Maintenance of biogeochemical cycling, storage, mineral-gaseous cycles, water-air quality. Decomposition, weathering, soil development-stability, soil quality. Maintenance of biological diversity. Absorbing, buffering, diluting, detoxifying pollutants-xenobiotics.

Ecosystem “goods”: food, construction materials, medicinal plants, wild genes for domestic plants and animals, Tourism and recreation. Ecosystem “services” : Maintaining hydrological cycles, Regulating climate, cleansing water and air, Maintaining the gaseous composition of the atmosphere, pollinating crops and other important plants, Generating and maintaining soils, storing cycling essential nutrients, Absorbing and detoxifying pollutants, providing beauty, inspiration, and recreation.

Valuation of ecosystem services: Economic valuation concept and methods used to link ecosystem functions to human values. Identification of potential ecosystems and associated services including water filtration and storage, habitat, carbon and nitrogen sequestration. Dimensions of economic value. Illustration of economic values of ecosystem goods and services. Methods for valuing ecosystem goods and services. Providing and financing ecosystem goods and services conditions of exchange. Examples of methods include using property values and participation in recreation opportunities, as well as surveys to assess individuals’ preferences.

#### **FRBD109E: Conservation ecology and sustainable development(Credit-4)**

This course emphasizes ecological principles important to conservation and development and the ecological consequences of development activities. Global biodiversity, decline terrestrial biodiversity. Global decline of wildlife population and conservation efforts. Ethics of conservation. Economics of conservation. Habitat degradation and loss of economic values. Over exploitation of renewable resources. Habitat fragmentation. Exotic species invasion. Conservation genetics and extinction process in an ecosystem. Species and landscape approaches to conservation. Future challenges in maintaining unsustainable ecosystem as population sinks for wildlife. Current and future challenges in the environment and population management. Conservation science, resource management, and environmental outreach.