Department of Forestry

Name of the Programme M.Sc. Forestry (Agroforestry)

Courses offer in Master Degree programme

Group		Number	Title of Course	Credit
Major	1.	FOR 501	Silviculture	2+0
	2.	FOR 502	Forest Biometry	1+1
	3.	FOR 503	Forest Management	2+0
	4.	FOR 504	Forest Products-Chemistry & Industries	2+1
	5.	FOR 505	Forest Ecology & Biodiversity Conservation	2+1
	6.	FOR 506	Forest Resources Management & Economics	1+1
	7.	FOR 507	Forest Protection	1+1
	8.	FOR 508	Forest Policy , Laws & International Convention	2+0
	9.	FOR 509	Tree Improvement	1+1
	10.	FOR 510	Forest & People	2+0
	Total			**22 (16+6)**
Seminar	1.	FOR 591	Credit Seminar	**1(0+1)**
Thesis research	1.	FOR 599	Research	**20(0+20)**
Minor (Agroforestry)	1.	AF 521	Agroforestry Systems	2+1
	2.	AF 522	Soil & Water Management in Agroforestry	1+1
	3.	AF 524	Fruit Plants, Trees & Shrubs for Agroforestry	2+1
	4.	AF 525	Economics of Agroforestry Systems	2+1
	5.	AF 526	Rangeland & Pasture Management	2+0
	6.	**Total**		**13(9+4)**
Supporting	1.	FOR 511	Computer Application & Information Technology	1 (0+1)
	2.	FOR 512	Remote Sensing & Geographic Information System	2 (1+1)
	3.	FOR 513	General Statistical Methods & Research Methodology	2 (1+1)
	Total			**5 (2+3)**
Non-Credit Compulsory Course	1.	PGS 501	Library and Information Services	1(0+1)
	2.	PGS 502	Technical Writing and Communications Skills	1(0+1)
	3.	PGS 503	Intellectual Property and its Management in Agriculture	1(1+0)
	4.	PGS 504	Basic Concepts in Laboratory Techniques	1(0+1)
	5.	PGS 505	Agril Res. Ethics and Rural Dev. Programs	1(1+0)
	6.	PGS 506	Disaster Management	1(1+0)
	7.	HVE	Human value and Professional Ethics	2(1+1)
	Total			**8(4+4)**
Grand total				**86(43+43)**

Department of Forestry

Name of the Programme M.Sc. Forestry (Agroforestry)

Minimum credit requirements

Subject	Master
Major	22
Minor	13
Supporting	05
Seminar	01
Thesis research	20
Total	61

Department of Forestry

Name of the Programme M.Sc. Forestry (Agroforestry)

Semester wise distribution of Courses

Course	Course Title	Course Code	Credit
Semester I			
Major	Silviculture	FOR-501	2(2+0)
	Forest Biometry	FOR-502	2(1+1)
	Forest Management	FOR-503	2(2+0)
	Forest & People	FOR-510	2(2+0)
	Forest Resource Management & Economics	FOR-506	2(1+1)
	Forest Ecology & Biodiversity Conservation	FOR-505	3(2+1)
Minor	Agroforestry System	FOR-AF-521	3 (2+1)
	Soil & Water Management in Agroforestry	FOR-AF-522	2 (1+1)
Supporting	General Statistical Methods & Research Methodology	FOR-513	2(1+1)
Compulsory NC	Library Information Services	PGS 501	1 (0+1)
	Intellectual Property Rights and its management in agriculture	PGS 503	1 (1+0)
	Basic concepts in Laboratory Techniques	PGS 504	1 (0+1)
	Human Values & Professional Ethics	HVE	2(1+1)
Semester II			
Major	Forest Products- Chemistry & Industries	FOR-504	3(2+1)
	Forest Policy, Laws & International Conventions	FOR-508	2(2+0)
	Tree Improvement	FOR-509	2(1+1)
	Forest Protection	FOR-507	2(1+1)
Minor	Fruit Plant, Tree & Shrubs for Agroforestry	FOR-AF524	3 (2+1)
	Economics of Agroforestry System	FOR-AF525	3 (2+1)
	Rangeland & Pasture Management	FOR-AF526	2 (2+0)
Supporting	Remote Sensing & Geographic Information System	FOR-512	2(1+1)
	Computer Application & Information Tech.	FOR-511	1(0+1)
Compulsory NC	Technical Writing and Communication Skill	PGS 502	1 (1+0)
	Agricultural Research Ethics and Rural Development Programme	PGS 505	1 (1+0)
	Disaster Management	PGS 506	1 (1+0)
Semester III			
	Comprehensive examination		
	Seminar	FOR-591	1(0+1)
	Thesis research	FOR-AF599	10 (0+10)
Semester IV			
	Thesis research	FOR-AF599	10 (0+10)

FOR 501 **Silviculture** **2+0**

Objective

To provide knowledge about Forest ecosystem concept, stand dynamics forest succession, productivity and vegetation forms and natural regeneration of tree species.

Theory

UNIT I Forest ecosystem concept, stand dynamics-forest succession, competition and tolerance, classification of world's forest vegetation.

UNIT II Productivity and vegetation forms of India, forest composition andstructure. Ecophysiology of tree growth, effect of radiation & water relationship, mineral nutrients and temperature.

UNIT III Natural regeneration of species and types including unevenaged silviculture. Intermediate treatments.

Suggested Readings

- Dwivedi AP. 1992. Agroforestry Principles and Practices. Oxford and IBH.
- Dwivedi AP. 1993. A Text Book of Silviculture. International BookDistributors, Dehradun.
- Khanna LS. 1996. Principle and Practice of Silviculture. International Book Distributors.
- Smith DM, Larson BC, Ketty MJ & Ashton PMS. 1997. The Practices of Silviculture-Applied Forest Ecology. John Wiley & Sons.

FOR 502 **Forest Biometry** **1+1**

Objective To develop understanding of students about tree measurements, forest inventory and yield concepts

Theory

UNIT I Measurement of tree parameters. Estimation of volume, growth and yield of individual tree and forest stands. Preparation of volume & its application, yield and stand tables.

UNIT II Forest inventory, Sampling methods adopted in forestry, Use of GPS in forest inventory. Measurement stand density. Simulation techniques.

UNIT III Growth and yield prediction models – their preparation and applications.

Practical

- Calculations of volume of felled as well as standing trees., Volume table preparation., Application of sampling procedures., Handling of GPS., preparation of yield and stand table.

Suggested Readings

Chaturvedi AN & Khanna LS. 1994. Forest Mensuration. International Book Distributor.
Ram Parkash 1983. Forest Surveying. International Book Distr.
Sharpe GW, Hendee CW & Sharpe WE. 1986. Introduction to Forestry. McGraw-Hill.
Simmons CE. 1980. A Manual of Forest Mensuration. Bishen Singh Mahender Pal Singh, Dehradun.

FOR 503 **Forest Management** **2+0**

Objective

To provide knowledge about forest management, ecosystem management, site quality evaluation, stand density & forest valuation.

Theory

UNIT I Principles of forest management; scope and object of forest management, ecosystem management, development of forest management in India.

UNIT II Site quality evaluation and importance. Stand density, classical approaches to yield regulation in forest management, salient features and strategies.

UNIT III Forest valuation and appraisal in regulated forests.

Suggested Readings

Dwivedi AP. 1992. Agroforestry Principles and Practices. Oxford and IBH.
Dwivedi AP. 1993. A Text Book of Silviculture. International Book Distributors, Dehradun.
Khanna LS. 1996. Principle and Practice of Silviculture. International Book Distributors.
Smith DM, Larson BC, Ketty MJ & Ashton PMS. 1997. The Practices of Silviculture-Applied Forest Ecology. John Wiley & Sons.

FOR 504 Forest Products – Chemistry and Industries 2+1

Objective

The course will equip the students regarding wood based industries. How it is affecting the economy of the country such as match and splint, sports and pencil making, besides this wood extracts resins and gums, katha, tannis and various type of non timber products. Practical will make them aware regarding extracting method of different products of wood.

Theory

UNIT I Importance of forest based industries in relation to Indian economy.Chemistry in relation to forest products.

UNIT II Description of different forest based industries - paper and pulp, furniture, bamboo, sports goods, pencil making, match box and splint making, use of wood of lesser known forest species for commercial purposes.

UNIT III Cell wall constituents. Chemistry of cellulose, starch, hemicelluloses and lignin. Extraneous components of wood – water and organic solvent soluble.

UNIT IV Chemical composition of oleoresin from major pine species. Structural difference among different gums (arabic, ghatti, tragacanth).

UNIT V Chemical nature and uses of volatile oils, tannins, katha and cutch. Chemical nature and uses of important forest based dyes and pigments.

Practical

- Estimation of cell wall contents – Hemicellulose and lignin, Extraction of essential oils, resins, tannins, Acetylation of wood, Visit to nearby forest based industries.

Suggested Readings

Anonymous. 1981. Wealth of India. CSIR.
Anonymous. 2007. Year Book of Forest Products. FAO.
Dwivedi AP. 1993. Forestry in India. Surya Publ.
Mehta T. 1981. A Handbook of Forest Utilization. Periodical Expert Book Agency.
Krishnamurthy – Minor Forest Products of India Oxford & IBH

FOR 505 **Forest Ecology and Biodiversity Conservation** **2+1**

Objective

To develop understanding of students about ecological aspects of forest, conservation of forest resources & biodiversity, consequences of depleting biodiversity and sustainable use of biodiversity.

Theory

UNIT I Advanced topics in forest ecology including forest population, forest community dynamics, forest community structure and analysis, forest productivity on a global scale, ecology of forest landscapes spatial heterogeneity; Hierarchy issues in ecology.

UNIT II Conservation of natural resources (hotspot areas, wildlife sanctuaries, national parks, biosphere reserve). Global warming and forests. Green House Effect and its consequences. Ozone depletion. Conservations laws and acts. Forest genetics resources of India timber and non timber species. Survey exploration and sampling strategies.

UNIT III Documentation and evaluation of forests genetical resources (FGR), *in situ* and *ex situ* conservation of gene resources. Biological diversity and its significance to sustainable use. Handling and storage of FGR. Intellectual property rights. Quarantine laws and FGR exchange.

Practical

- Study of forest community structure and its successional status, Estimation of productivity of forest ecosystem, Trip to different regions of the state to study forest vegetation, Collection and preservation of specimen, Methods of vegetation analysis, Measurement of biomass and productivity, Quantification of litter production and decomposition, Visit to national parks, wldlife sanctuaries, botanical gardens and arboreta.

Suggested Readings

Anonymous 2006. Report of the National Forest Commission. Govt. of India.
Dhyani SN. 1994. Wildlife Management. Rawat Publ. 19
Huxley P. 1999. Tropical Agroforestry. Blackwell.
Khan TI & Al-Azmi DN. 1999. Global Biodiversity Conservation Measures. Pointer Publ.
Kimmins JP. 1976. Forest Ecology. MacMillan.
Nautiyal S & KoulAK. 1999. Forest Biodiversity and its Conservation Practices in India. Oriental Enterprise.
Ramakrishnan PS. 1992. Shifting Agriculture and Sustainable Development. Man and Biosphere Series. The Parthenon Publ. Group.

FOR 506 Forest Resource Management And Economics 1+1

Objective

To develop understanding of students about forest resource management and economics management decisions, natural and environmental resource accounting.

Theory

UNIT I Application of microeconomics in solving forest resource problems. Emphasis on forest products demand and supply analysis, forest products marketing, forest capital theory.

UNIT II Inter-regional and international trade in forest products. Impact of economics and physical variables upon forest appraisal and management decisions. Externalities and property rights.

UNIT III Natural and environmental resource accounting –methods and implications. Application of operations research tools in evaluating forest management alternatives in public and private forest planning.

Practical

- Exercises on estimation of demand and supply functions; biodiversity valuation, valuation of non-marketed forest products. Exercises on financial and economic appraisal of forestry projects. Exercises on marketing of forest products and international trade competitiveness. Computer applications for using programming techniques in evaluating forest management alternatives.

Suggested Readings

FAO 1986. Guidelines to Practical Project Appraisal. Natraj Publ.
Kerr JM, Marothia DK, Singh K, Ramaswamy C & Beritley WR. 1997. Natural Resource Economics Theory and Applications in India. Oxford & IBH.
Nautiyal JC. 1988. Forest Economics – Principles and Applications. Natraj Publications, Dehradun.
Sharma LC. 1980. Forest Economics, Planning and Management. International Book Distributors, Dehradun.

FOR 507 **Forest Protection** **1+1**

Objective

To provide knowledge to students about forest protection through diseases & pest management.

Theory

UNIT I Important diseases and insect pests of nurseries, farm forestry, plantations, avenue trees and their management. Assessment of losses due to diseases, insect pests, vertebrate pests, adverse weather, forest fires and weeds. Insect pests and mycoflora of seeds of forest trees and their management.

UNIT II Biodegradation of wood – microscopic and chemical effects of white rot, brown rot, soft rot and wood discoloration. Heart rots – factors affecting heart rots, damage caused, compartmentalization of decay in trees and management of heart rots. Role of mycorrhiza in tree health.

UNIT III Theories of natural regulation of insect populations. Wildlife damage in nurseries, plantations and their management. Weed problems in nurseries, plantations and their control. Adverse climatic factors, acid rains and air pollutants in relation to forest tree health.

UNIT IV Biological control of insect pests and diseases of forest trees. Molecular tools for developing disease resistance trees.

Practical

- Collection, identification and preservation of important insect pests and disease specimens of forest plants. Detection of insect infestation and seed borne mycoflora. Assessment of losses due to diseases, insect pests etc. Habitat management of vertebrate pests. Laboratory tests for estimating decay resistance in wood. Fire control methods and devices, Familiarization with the meteorological and plant protection equipment, Application of pesticides and bio-control agents in the management of insect pests, weeds, diseases in nurseries and plantations, Extraction of spores of arbuscular mycorrhizal (AM) fungi from soil and assessment of mycrorrhizal root infection.

Suggested Readings

Bakshi BK. 1976. Forest Pathology. Controller of Publications, GOI.
Jha LK & Sen Sarna PK. 1994. Forest Entomology. Ashish Publ. House.
Manion PD. 1991. Tree Diseases Concept. Prentice Hall.
Stebbings EP. 1977. Indian Forest Insects. JK Jain Bros.

FOR 508 Forest Policy and Laws and International Conventions 2+0

Objective

To develop understanding of students about forest policy and laws and international conventions

Theory

UNIT I Forest policy – Relevance and scope; National Forest Policy – 1894, 1952 and 1988;

UNIT II General principles of criminal law; Indian Penel Code, criminal procedure code; Indian evidence act applied to forestry matters.

UNIT III Forest laws; Indian Forest Act –1927, general provision and detailed study; Forest Conservation Act 1980, Wildlife Protect Act 1972 Important Forest Rules and Guidelines.

UNIT IV Important case studies and landmark judgments.

Suggested Readings

Indian Forest Acts (with short notes)1975. Allahabad Law Agency.
Jha LK. 1994. Analysis and Appraisal of India's Forest Policy. Ashish Publ. House.
National Forest Policy 1952. Ministry of Food and Agriculture, New Delhi.
National Forest Policy 1988. Ministry of Environment and Forests, New Delhi.
Negi SS. 1985. Forest Law. Natraj Publ.
Saharia VB. 1989. Wildlife Law in India. Natraj Publ.

FOR 509 **Tree Improvement** **1+1**

Objective To acquaint the students about general principles of tree breeding with examples of important trees.

Theory

UNIT I General concept of forest tree breeding, tree improvement and forest genetics.

UNIT II Reproduction in forest trees, dimorphism pollination mechanisms. Pollen dispersion distances, pollinators and their energetics. Attractants for pollinators. Pollen handling forced flowering for seed orchard manipulation. Pollination mechanisms.

UNIT III Variation in trees importance and its causes. Natural variation as a basis for tree improvement. Geographic variations – Ecotypes, clines, races and land races.

UNIT IV Seed, seed formation, dispersal, storage, stratification and seed dormancy.

UNIT V Selective breeding methods- mass, family, within family, family plus within family. Plus tree selection for wood quality, disease resistance and agroforestry objectives. Selection strategies and choice of breeding methods and progress in selective breeding in forest trees. Indirect selection for biotic and abiotic stresses.

UNIT VI Progeny and clone testing. Seed orchards – type, functions and importance. Estimating genetic parameters and genetic gain.

UNIT VII Heterosis breeding inbreeding and hybrid vigour. Manifestation and fixation of heterosis. Species and racial hybridization. Indian examples – teak, sal, shisham, eucalypts, acacias, pines and poplars.

UNIT VIII Polyploidy, aneuploidy and haploidy in soft and hard wood species. Induction of polyploidy. Hardy-weinberg law, null hypothesis, Wohlund's Principle.

UNIT IX Biotechnology in tree improvement. Mutation breeding.

UNIT X Economics of tree breeding.

Practical

- Floral biology, modes of reproduction and modes of pollination in forest trees. Estimating pollen viability. Controlled pollination and pollen handling. Manipulation of flowering through hormones. Identification of ecotypes, races, and land-races in natural forest. Visit to species, provenance and progeny trials. Selection of superior phenotypes. Marking of candidate trees, plus trees and elite trees. Visit to seed orchards. Comparison of parents and their putative hybrids. Induction of polyploidy through colchicine treatment.

Suggested Readings

Mandal AK & Gibson GL. (Eds). 1997. Forest Genetics and Tree Breeding. CBS.
Surendran C, Sehgal RN & Paramathma M. 2003. Text Book of Forest Tree Breeding. ICAR Publ.
White JW. 1976. Introduction to Forest Genetics. Academic Press.
Zobel BJ & Talber J. 1984. Applied Forest Tree Improvement. John Wiley & Sons.

FOR 510 Forest and People 2+0

Objective

It will help students to understand socio-economic, cultural and ecological relationship between forests and people. It will acquaint students with the role of people in forest management through analysis of need dependence and traditional interactions between forests and society.

Theory

UNIT I Forests and its importance, forest societies, interactions between forests and people, importance of forests in traditional farming systems, livestock economy and forests, social and cultural factors of forest management, man in ecosystem in relation to eco-philosopy.

UNIT II Afforestation programmes and forest conflicts, wildlife and human conflicts, important forest movements like Chipka Movement, Gender dimension of forest management, tribal economy and forests. Pastoralists and their dependence on forests. Forests and economic security of tribals.

UNIT III Management of Commons and Common Property Resources (CPRs) and open access resources, forest management and sustainable livelihood strategies, forests and food security, eco-tourism and local development, land use change and forestry.

UNIT IV Forest rights, customary rights of people, community participation, biodiversity and ethnobotany, Joint Forest Management, global environmental change and land use; dams, forests and resettlement of tribals and non-triabals – case study, poverty alleviation and forests, tourism and forest management, role of NGOs and other CBOs community based organization in forest management.

Suggested readings

Annamalai R. 1999. Participatory Learning Action and Microplanning for JFM. Dean SFRC, Coimbatore.
FAO. 1978. Forestry for Local Community Development. FAO Publ.
Shah SA. 1988. Forestry for People. ICAR.
Tiwari KM. 1988. Social Forestry and Rural Development. International Book Distr.
Vyas GPD. 1999. Community Forestry. Agrobios.

FOR-AF 521 Agroforestry Systems 2+1

Objective

To impart knowledge on the concept of agroforestry land use including diagnosis & design methodologies.

Theory

UNIT I Agroforestry objectives, importance, potential and impediments in implementation. Land capability classification and land evaluation.

UNIT II Overview of global agro-forestry systems, shifting cultivation, taungya system, multiple and mixed cropping, alley cropping, shelter-belts and windbreaks, energy plantations and homestead gardens. Productin potential of different silvi-pasture system.

UNIT III Concepts of community forestry and social forestry, linear strip plantations.

UNIT IV Diagnosis and Design – Trends in Agroforestry systems research and development.

Practical

- Survey and analysis of land use systems in the adjoining areas. Design and plan of suitable models for improvement.

Suggested Readings

Dwivedi AP. 1992. Agroforestry Principles and Practices. Oxford & IBH.
Nair PKR, Rai MR & Buck LE. 2004. New Vistas in Agroforestry. Kluwer.
Nair PKR. 1993. An Introduction to Agroforestry. Kluwer.
Ong CK & Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.
Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.
Young A. 1997. Agroforestry for Soil Management. CABI.

Minor course

FOR-AF 522 Soil and Water Management in Agroforestry 1+1

Objective

To impart knowledge on soil and water management in agroforestry including biogeochemical cycling of nutrients.

Theory

UNIT I Soil and water management –objectives and scope in relation to agroforestry systems. Soil and water conservation , land classification and carrying capacity. Irrigation potential and methods. Optimization of waters use in agroforestry systems and dry land farming .

UNIT II Soil water relations, moisture regimes and management techniques. Problem soils and their management, soil organisms and nitrogen fixation.

UNIT III Biogeochemical cycling of nutrients including organic matter decomposition. Nutrients budgeting and soil productivity under different agroforestry systems.

Practical

- Calculation of water storage and fluxes in the soil. Determination of "insitu infiltration rate of soils. Measurement and estimation of run-off . Mineral nutrient analysis of soil and plants. Study of biogeochemical cycles in agro-forestry systems.

Suggested Readings

Dwivedi AP. 1992. Agroforestry Principles and Practices. Oxford & IBH.
Nair PKR, Rai MR & Buck LE. 2004. New Vistas in Agroforestry. Kluwer.
Nair PKR. 1993. An Introduction to Agroforestry. Kluwer.
Ong CK & Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.
Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.
Young A. 1997. Agroforestry for Soil Management. CABI.

FOR-AF 523 Crops and Animals Production Management in Agroforestry 2+1

Objective

To impart knowledge on interactions between tree and live stock including their management, principles of crops and fodder production in agroforestry

Theory

UNIT I Choice of inter-crops for different tree species, sowing and planting techniques. Planting patterns, crop geometry, nutrient requirements, and weed management. Management of fodder tree species, thinning, lopping, pruning. Ecological and socio-economic interactions

UNIT II Role of tree architecture and its management on system's productivity. Production potentials of fodder based agroforestry system in different agro climatic conditions. Crop combination, crop combination interactions in crop mixtures. Importance of cattle –sheep and goat vis-à-vis agro-forestry systems. Feed and fodder resources in agro-forestry systems and live stock management.

UNIT III Nutrient analysis of forages derived from fodder trees/shrubs. Nutrient requirement for various livestock and their ration computation with agroforestry forages and tree leaves. Forage and tree leaves preservation.

UNIT IV Calendars for forage crop production in agro-forestry systems including lopping schedules. Optimization of animal production. Animal products technology and marketing.

UNIT V Integrated Agroforestry Farming System

Practical

- Measurement of crop growth rates. Study of tree crop association and management methods. Quantitative evaluation of tree-crop, livestock. Analysis of forages and feeds for mineral and incrementing constituents. Digestibility of some agro-forestry forages. Preparation of leaf meal and forage conservation. Familiarity with common veterinary instruments, Ail equipments and common feeds and fodders & Field visits.

Suggested Readings

Dwivedi AP. 1992. *Agroforestry Principles and Practices*. Oxford & IBH.
Nair PKR, Rai MR & Buck LE. 2004. *New Vistas in Agroforestry*. Kluwer.
Nair PKR. 1993. *An Introduction to Agroforestry*. Kluwer.
Ong CK & Huxley PK. 1996. *Tree Crop Interactions – A Physiological Approach*. ICRAF.
Thampan PK. 1993. *Trees and Tree Farming*. Peekay Tree Crops Development Foundation.
Young A. 1997. *Agroforestry for Soil Management*. CABI.

FOR-AF 524 Fruit Plants, Trees and Shrubs for Agroforestry 2+1

Objective To make students familiar with trees and shrubs (fruit, fodder and small timber) suitable for agorforestry.

Theory

UNIT I Introduction, importance of woody elements in agro-forestry systems, their role in biomass production. Suitability of species for different purposes. Multipurpose trees in agro-forestry systems. Fodder from trees/shrubs and their nutritive value propagation techniques.

UNIT II Fruits crop and their need and relevance in Agroforestry fruits tree suitable for various assemblage and then planting plan in different agro climatic situation and Agroforestry system. Modification in tending and pruning floor. Fertility management, yield and quality improvement.

UNIT III Role of nitrogen fixing trees/ shrubs. Choice of species for various agro climatic zones for the production of timber, fodder, fuel wood, fibre, fruits, medicinal and aromatic plants. Generic and specific characters of trees and shrubs for Agroforestry. Generic and specific characters of trees and shrubs for agro-forestry.

Practical

- Field survey and acquaintance with specialized features of trees, shrubs and fruit species and varieties for Agroforestry. Planting plans including wind breaks. Training and pruning of tree, shrubs and fruit trees for enhancing production in Agroforestry system.

Suggested Readings

Dwivedi AP. 1992. Agroforestry Principles and Practices. Oxford & IBH.
Nair PKR, Rai MR & Buck LE. 2004. New Vistas in Agroforestry. Kluwer.
Nair PKR. 1993. An Introduction to Agroforestry. Kluwer.
Ong CK & Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.
Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.
Young A. 1997. Agroforestry for Soil Management. CABI.

FOR-AF 525 Economics of Agroforestry Systems 2+1

Objective To acquaint the students with principles of economics and use of economic tools in appraisal of the agroforestry systems.

Theory

UNIT I Basic principles of economics applied to agro-forestry. Optimization techniques- Planting, budgeting and functional analysis. Role of time, risk and uncertainty in decision making.

UNIT II Financial and socio-economic analysis of agro-forestry projects.

UNIT III Principles of financial management and harvesting, post harvest handling marketing of agro-forestry products including benefit sharing.

Practical

- Exercises on agro-forestry production relationships. Preparation of enterprise, partial and complete budgets. Application of various methods in formulation and appraisal of agro-forestry projects. Case studies on harvesting, post harvest management and marketing of agro-forestry products.

Suggested Readings

Dwivedi AP. 1992. Agroforestry Principles and Practices. Oxford & IBH.
Nair PKR, Rai MR & Buck LE. 2004. New Vistas in Agroforestry. Kluwer.
Nair PKR. 1993. An Introduction to Agroforestry. Kluwer.
Ong CK & Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.
Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.
Young A. 1997. Agroforestry for Soil Management. CABI.

Minor course

FOR-AF 526 Range Land and Pasture Management 2+0

Objective To develop understanding of students about watershed management and Range Land Management.

Theory

UNIT I Concept of watershed management. Ideo-types of watershed development plans and activities for the watershed. Criterion for watershed size determination.

UNIT II Principles and practices of range land management. Improvement of range productivity by vegetation manipulation through control of undesirable vegetation, burning, fertilization, soil and water conservation and protection. Range improvement and livestock management.

UNIT III Feeding habits and grazing behavior of range livestock. Optimal livestock and range utilization, fodder from trees/shrubs and their nutritive values, propagation techniques, Micro climatic studies, root behavior, crown architecture including methods for minimizing unfavorable interactions.

UNIT IV Production potential of different silvi-pasture systems.

UNIT V Characteristics of a watershed and their role in watershed management. Quantification of the benefits and effectiveness of the package of practices adopted for management of watershed, Dynamics vis-à-vis plant growth and post harvest processing for evaluation of chemical constituents.

UNIT VI Biological and engineering approach in the management of degraded and denuded habitats as an integrated and multiple approach. SPP Testing. Provenance trials. Seed certification and storage. Elite trees selection.

Suggested Readings

Dwivedi AP. 1992. Agroforestry Principles and Practices. Oxford & IBH.
Nair PKR, Rai MR & Buck LE. 2004. New Vistas in Agroforestry. Kluwer.
Nair PKR. 1993. An Introduction to Agroforestry. Kluwer.
Ong CK & Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.
Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.
Young A. 1997. Agroforestry for Soil Management. CABI.

Supporting Course

FOR 511 Computer Application and Information Technology 0+1

Objective

To develop understanding about Computer based modeling, data base management and networking.

Practical

- Working with MS-DOS. Database design. Data entry operation. Word processing MS Office. Database management programme. Use of electronic spread sheet and graphics. Use of SPSS statistical application packages. Working with MS-DOS. Database design. Data entry operation. Word processing MS Office. Database management programme. Use of electronic spread sheet and graphics. Use of SPSS statistical application packages. Features of Information Technology Introduction to Information Technology – Basis of computer networking - LAN, WAN – BUSTokening- star-internet, intranet – Basics of E-mail – Exposure to web browsing(structure of URL), Types of web sites – internet service provider – using internet news – scope of IT in forestry

Suggested Readings

Balaguruswamy E. 1998. Programming with ANSI C. Tata McGraw Hill.
Gottfried B. 1999. Programming with C. Schaum Outline Series. Tata McGraw Hill.
IASRI 1999. Introduction to MS Office 97 and SPSS. IASRI Publ.
Malvino AP & Brown JA. 1999. Digital Computer Electronics. Tata McGraw Hill.
Mano MM. 1999. Digital Logic and Computer Design. Prentice Hall of India.
Tanenbaum AS. 2003. Computer Networks. Prentice Hall of India.

Supporting Course

FOR 512 Remote Sensing and Geographic Information System 1+1

Objective

To acquaint with the use of imageries, GIS and simulation in forest survey and management.

Theory

UNIT I The use of aerial photography, satellite imagery and geographic information system for the collection, storage and spatial analysis for georeferenced forest resources data and information.

UNIT II The integration of spatial data analysis systems with knowledge-based systems and/or simulation systems for the development of information/decision support systems for forest management; satellite systems; satellite imageries – techniques, uses and limitation;

UNIT III Future prospects of remote sensing in India; softwares used in remote sensing ; GIS versus remote sensing; GIS Software used in forestry and environments; Analysis of data; Application of GIS in forestry.

Practical

- Uses of various photogrammetry instruments, recognition and identification of objects on photography, compilation of maps and their interpretation, Hands on practice on remote sensing and GIS, software.

Suggested Readings

Burrough PA. 1990. Principles of GIS for Land Resources Assessment.Oxford & IBH.
Lillsand TM. 1989. Remote Sensing and Image Interpretation. John Wiley.
Narayanan LRA. 1999. Remote Sensing and its Application. Universities Press (India) /Orient Longman.
Sharma NK. 1986. Remote Sensing and Forest Survey. International Book Distr.

Supporting Course

FOR 513 General Statistical Methods & Research Methodology 1+1

Objective

To provide exposure about methods of statistical analysis, designs and sampling techniques.

Theory

UNIT I Introductory Statistics scales of measurement, concept of graphical, exploratory and inferential data analysis, important variables of forestry sector

UNIT II Probability and probability distributions Review of probability theory, concept of random variable and expectation, probability distributions (Binomial, Poisson, Normal, Weibull)

UNIT III Correlation and regression Simple, Rank, Partial, Multiple, Infraclass correlations, Furnivall Index and coefficient of determination. Linear and nonlinear regressions, parabolic, exponential, power and logarithmic functions

UNIT IV Estimation and Testing of Hypotheses, Concept of point and interval estimation, estimators and estimates, properties of good estimators – unbiasedness and minimum variance, tests of significance – t, F, z, and $\chi 2$, testing significance of correlation and regression coefficients, analysis of variance (ANOVA) – one way and two way classification with single and more than one cell frequency.

UNIT V Design of Experiments. Principles of experimental designs, Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD), Row- Column (alpha) designs, Split Plot and Strip Plot Designs.

UNIT VI Sampling – Theory and applications Why sample? Simple Random Sampling (with and without replacement), Stratified Random Sampling, Double sampling, Multistage sampling, Cluster sampling

UNIT VII Multivariate statistical techniques Multivariate Analysis of Variance, Principal Component Analysis, Factor Analysis, Cluster Analysis.

Practical

- Fitting of probability distributions, Computation of correlations and regressions, Tests of significance – t, F, z and $\chi 2$, Exposure to statistical packages SPSS and GENSTAT for ANOVA, multivariate analysis Laying out of designs in the field (i) Fan design, (ii) Latin Square, (iii) Randomized block design, (iv) Split plot design, (v) Row-Column designs and (vi) Scattered block. Data analysis of the above designs.

Suggested Readings

Dear KBG, Mead R & Relay J. 1987. Statistical Tools for Agro-Forestry Research – Bivariate Analysis for Intercropping Experiments. ICRAF, Nairobi.

Matin J. 1976. Principles of Database Management. Prentice Hall.

Pase UG & Sukhatme MU. 1978. Statistical Methods for Agricultural Workers. ICAR.

Surendran C, Sehgal RN & Paramathma M. 2003. Text Book of Forest Tree Breeding. ICAR.

PGS 501 Library and Information Services 1(0+1)

Objective To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; ere sources access methods.

PGS 504 Basic Concepts in Laboratory Techniques 1(0+1)

Objective To acquaint the students about the basics of commonly used techniques in laboratory.

Practical Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

Suggested Readings

Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.
Gabb MH & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.

PGS 505 Agriculture Research, Research Ethics and Rural Development Program's 1(1+0)

Objective To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT I History of agriculture in brief; Global agricultural research system need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR) International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II Research ethics research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III Concept and connotations of rural development, rural development policies and strategies. Rural development programmes Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings

Bhalla GS & Singh G. 2001. Indian Agriculture- Four Decades of Development. Sage Publ.
Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
Rao BSV. 2007. Rural Development Strategies and Role of Institutions- Issues, Innovations and Initiatives.
Singh K.. 1998. Rural Development Principles, Policies and Management. Sage Publ.

PGS 506 Disaster Management 1(1+0)

Objective To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and apacity building.

Theory

UNIT I Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change Global warming, Sea Level rise, Ozone Depletion

UNIT II Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response Police and other organizations.

Suggested Readings

Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe A Handbook of Disaster Management. Routledge.
Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

PGS 502 Technical Writing and Communications Skills 1(0+1)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

- **Technical Writing -** Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

- **Communication Skills -** Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern Weak forms in connected speech Participation in group discussion Facing an interview; presentation of scientific papers.

Suggested Readings

Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India. Collins' Cobuild English Dictionary. 1995.
Harper Collins. Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.
Hornby AS. 2000. Comp.Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press. James HS. 1994. Handbook for Technical Writing. NTC Business Books.
Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
Mohan K. 2005. Speaking English Effectively. MacMillan India. Richard WS.1969. Technical Writing.
Barnes & Noble. Robert C. (Ed.). 2005. Spoken English Flourish Your Language.
Abhishek. Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

PGS 503 Intellectual Property and Its management in Agriculture 1(1+0)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

- Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
Ganguli P. 2001. Intellectual Property Rights Unleashing Knowledge Economy. McGraw-Hill.
Intellectual Property Rights Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.
Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation. Rothschild M & Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries A Compendium on Law and Policies. Daya Publ. House.
The Indian Acts - Patents Act, 1970 and amendments;
Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.