CURRICULA AND SYLLABI FOR MASTER’S DEGREE PROGRAMS IN FORESTRY

- SILVICULTURE AND FOREST MANAGEMENT
- AGROFORESTRY AND ECOLOGY
- GENETIC RESOURCES, TREE BREEDING AND BIOTECHNOLOGY
- FOREST UTILIZATION
- FOREST PROTECTION

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EDUCATION DIVISION
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NEW DELHI-110 012
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The revised curricula and syllabi for U.G. Programs based on the ICAR model curricula have been implemented by all agricultural university from the academic year 1998-99 and the new courses at the under-graduate level have now been running for more than three years. It is but natural that the curricula ought to be revised at the Master's level too, to bring about the desired uniformity at the national level for easy student movements and maintaining uniformly high standards of P.G. education. For this purpose, the ICAR constituted 16 Broad Subject Matter (BSM) Committees in different areas of Agriculture and Allied Sciences including one in Forestry through the ICAR Office Order No. 1-3/98-Acdn/Edn dated 30th November, 1998.

The BSM Committee on forestry consisted of Dr. P.K. Khosla, Vice-Chancellor, HPKV, Palmpur as its Coordinator, and Dr. A.M. Chandrashekharaiah of University of Agricultural Sciences, Sirsi Campus (Karnataka); Prof. O.P. Toky of CCS Haryana Agricultural University, Hisar; Prof. Sunil Puri of Indira Gandhi Agricultural University, Raipur; Prof. R.S. Dhanda of Punjab Agricultural University, Ludhiana; Prof. R.N. Sehgal of Dr. Y.S. Parmar University of Horticulture and Forestry, Solan and Prof. B.S. Nadagouda of University of Agricultural Sciences, Dharwad as members.

The BSM Committee organized a total of 5 meetings/meeting-cum-workshops to develop the curricula and syllabi (see Annexure-II). The Indian Council of Forestry Research and Education (ICFRE) developed a National Model for M.Sc. Forestry curriculum for general universities, which was also discussed in a meeting held on 24-02-2001 at ICFRE, Dehradun under the aegis of Education Division of ICFRE. The main suggestions which came up during this meeting were: (1) there should be provision of field visits and practical classes; (2) topics like global environment, climatic changes, biodiversity conservation, habitat conservation and ecosystem dynamics are very important and need to be taught to forestry students. (3) Supporting courses such as statistics, computer education, remote sensing, geographic system and inventory preparation must find place in the curricula. All these suggestions have been incorporated adequately at appropriate places in the present curricula.

We are thankful to all the members of the BSM Committee and invitees of the meeting-cum-workshops for their active participation and contribution in finalizing the curricula. This was a gigantic task because a lot of variation existed in the curricula of different universities. The assistance provided by Mr. Sushil Kumar, Research Associate at CCS HAU, Hisar in preparation of the final document is duly acknowledged.

We are also thankful to NAAS, New Delhi; HPKV, Palampur; UAS, Dharwad; PAU, Ludhiana and ICFRE, Dehradun for providing facilities for organizing meetings/workshops of the BSM Committee.
We are particularly thankful to Dr. S.L. Mehta, Dr. P.L. Gautam, and Dr. Kirti Singh who set the ball rolling by participating in the first meeting at NAAS, New Delhi and highlighting the concept behind the revision of the curricula. Thanks are also due to Dr. M. Mahadevappa former Vice-Chancellor, UAS, Dharwad for actively participating in the meeting at Dharwad.

We gratefully acknowledge the guidance and encouragement received from Dr R.S. Paroda, former Secretary (DARE) and DG, ICAR and Chairman of Accreditation Board in restructuring PG course curricula and syllabi for Forestry. We are grateful to Dr. S.L. Mehta and Dr. (Mrs.) Tej Verma, former DDG(Edn.) for providing help in restructuring the curricula.

Our thanks are also due to Dr. Panjab Singh, Secretary, DARE, D.G., ICAR and Chairman of the Accreditation Board and Dr. J. C. Katyal, DDG(Edn) for their support in bringing out this document.

We hope that this document will serve as a guide in achieving uniformly high standards of postgraduate education in Forestry. The Accreditation Board Secretariat will appreciate comments and suggestions for improving and updating this publication in future.

New Delhi-12
May, 2002

O.P. Toky
N.L. Maurya
G.D. Diwakar

P.K. Khosla
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INTRODUCTION

Background information

Teaching of forestry, research and extension in India had been a preserve of the Federal and State Forest Services till 1985 when the Indian Council of Agricultural Research (ICAR), New Delhi stepped in to introduce undergraduate program in forestry in six Indian Agricultural Universities. The starting of Forestry Degree Program in the universities was more or less a consequence of the general awareness to the environmental and forestry related problems. The media played a very active role in highlighting the problems of deforestation, wasteland formation, developmental activities to the detriment of the forests and the environment in general.

The highest circle in the Ministry of Environment and Forests, Government of India (GOI) realized that the country did not have suitable manpower educated in forest science to organize the field jobs, to check the increasing degradation of green cover through scientific management. This was the transitional period when the traditional forestry was going into the background and being replaced by new emerging programs like agroforestry, social forestry, community forestry, farm forestry, etc. The forest trees were now being looked upon as a resource for the farmer and the rural poor, which was earlier, treated as merely a source of revenue for the governments. The Government of India (GOI) directed the ICAR to start degree program in Forestry to generate trained manpower to achieve the target of the GOI to afforestate 5 m ha of wastelands every year through social forestry programs. Forestry was thought to be more akin to agriculture; hence, the Indian Council of Agricultural Research (ICAR) took the initiative to start forestry education in the universities.

History of forestry education in the world

The first systematic program of forestry education was started in 1763 at 'Master Schools' in Germany at Harting and Cotta where the pupils lived and worked in close association with the teachers to attain professional proficiency. "Master Schools' spread widely from these two places and the German foresters were invited to Russia to take charge of forest management and to educate foresters. As the dependence upon renewable raw material increased after the industrial revolution in Europe, the birth of local and federal forestry schools took place. The first forestry school was established in Austria by Prince Schwarzenberg and Prince Liechtenstein, the two largest owners of forest land. This was followed by the State owned forestry schools more or less on the pattern of military academics in various countries. These date back to 1790 at Munich (Bovaria), 1803 at St. Petersburg (Russia), 1813 at Mariabrunn (Austria), 1825 at Nancy (France), 1828 at Stockholm (Sweden), 1848 at Turin (Italy), 1878 in Russia, and later on in Poland, and the Scandinavian countries.
This was an era of forest exploitation and these managerial schools produced foresters to man Federal Forestry Services.

In due course, it was realized that the management of forests is an intricate process involving biological principles. As a result, forestry education like agriculture, engineering, medicine, etc. made inroads into university curriculum. The practitioner-oriented schools gave way to the university schools. The Austrian school at Mariabrunn was the first to be transferred to the University of Agriculture in Vienna in 1875. In 1898, the first forestry school was established at Yale University. The Commonwealth Forestry Institute, Oxford, now called 'Oxford Forestry Institute' was started as an 'Imperial School of Forestry' in 1905 to produce superior foresters for the Indian Empire and by 1919 it started awarding degree in forestry.

In the later years, several of the previously independent schools developed university connections so much so that Shirley listed only six forestry schools out of a total of 137 (excluding Russia and China) which were partially independent of a university affiliation. Forest Research Institute and College, Dehradun, India, a part of which is now known as 'Indira Gandhi National Forest Academy', was the only Centre of Forestry Education in the world, without affiliation to any university. Now, of course, the Forest Research Institute, Dehradun has been given the status of a 'Deemed University' by the University Grants Commission and it functions as an institute of the Indian Council of Forestry Research and Education (ICFRE), at Dehradun.

**Forestry education and training in India**

The Indian Forest Service was established in 1867 with initial arrangement for training with forestry schools of Europe. In 1885, the Forestry College at Cooper Hill, England was established to impart forestry education to Indian forest officials. Later in 1905, the training of Indian Forest Probationers was transferred to the British Universities; first at Oxford and later at Cambridge and Edinburgh. The higher training in forestry was imparted in England, for lower ranks and for research purposes, the Forest Research Institute was started in 1878 at Dehradun. The first batch of six Rangers passed out in 1881. From 1926, the arrangement to train Indian Forest Service probationers was developed at Dehradun itself. The present Indian Forest College was opened in 1938 and continues to enjoy the same status till today with a change only in its nomenclature as given above.

The present forestry training system is not very relevant to the needs of modern India. It follows the same style and form viz. (an in-service training) and it is of the same duration (2 years) as in the 1860's. All over the world, except India, forestry at the professional level is taught in the universities or technological institutions for 4-5 years followed by an in-service training of short duration ranging from six months to one year. The status of this academy is
equivalent to other similar academies established in the country for imparting administrative training to the Indian Administrative Services (IAS) and Indian Police Services (IPS) probationers.

At the thirteenth session of the FAO Advisory Committee on Forestry Education in Mexico City during June, 1985 while discussing the influence of the Advisory Committee since its inception in 1964 on Forestry Education in the developing countries, attention was drawn to the imbalance between university education and technical and vocational training and to the need to train foresters at all levels and, more generally, to the necessity to adjust forestry training to the real needs of the world. The need was also felt for forestry education to come out of isolation brought about by its institutional structures.

The introduction of forestry education in the Indian universities is very recent and Forest Research Institute and Colleges enjoyed the singular status for imparting forestry education in India. The Forest Research Institute and Colleges, before becoming an academy was comprised of four directorates namely: i) Directorate of Forest Education, ii) Directorate of Forest Research, iii) Directorate of Biological Research and iv) Directorate of Forest Products. Of these, the Directorate of Forest Education was solely responsible for forestry education in the country. Forestry education in universities was envisaged as a means to remove some of the deficiencies in training and imparting academic complexion to the professional knowledge.

There are also some specialized institutions in India, which provide only specialized forestry education. Notable amongst these are:

1. Indian Institute of Forest Management, Bhopal, India, established in 1982 providing training in forestry management.

2. Wildlife Institute of India, Dehradun, a part of the FRI till 1986 when it became an autonomous institute, which trains staff for wildlife research and management.

3. Indian Plywood Industries Research Institute, Bangalore, responsible for developing new technologies and training people in plywood manufacturing and mechanical wood processing.

4. Institute of Paper Technology, Saharanpur, which imparts degree program in pulp and paper technology.

In India, most of the forestry colleges at university level are oriented towards the biological and to some extent silvicultural aspects of forestry, with a little attention being given to socio-economic aspects, to harvesting and utilization, and to wood science and technology. There is a great need to mobilize resources to set-up programs in deficit subject matter areas of technical and vocational training, besides strengthening library, laboratory and workshops for practical work.
Forestry V* agroforestry education

Agroforestry looks at the relationship among different land use components such as forestry, horticulture, crops and livestock. It differs from social forestry management model, which includes the managerial and political mechanisms used to implement forestry projects focused on the needs of the local people. The concept and practice of social, community or participatory forestry is traditional in most of the countries of Asia, but India has pioneered many new approaches in recent years. With a focus on the rural poor, social forestry projects were designed and implemented on revenue lands and other common lands to produce the needed products. Almost all social forestry schemes use agroforestry technologies. The clients, generally resource poor families, need food, fodder, fuelwood, small poles, and minor forest products. Because of subsistence needs, they seldom can survive by growing forest trees alone for cash income. Consequently, improved agroforestry systems lead to better performance by social forestry programs, including equity or distributional criteria.

Although, Indian leaders recognized the advantages of agroforestry, but available information was meager and poorly organized. Virtually no research capacity on forest trees existed. The forest trees were not under the purview of the ICAR and foresters with outstanding achievements were few to fill the research requirements. Consequently, the country had to rebuild its forestry research capacity, including defining new dimensions of excellence, while building new capacity in agroforestry.

All this activity in the build-up of forestry research capability brought into focus the need for starting forestry education in some of the agricultural universities. The College of Agriculture of the HP University (which now enjoys the status as Dr.Y.S.Parmar University) was the first in the country to start M.Sc. (Forestry) program during 1976-77. This university also started elective courses in Forestry for the B.Sc. (Agriculture) programs.

In 1985, the then Prime Minister held a meeting of the Ministry of Environment and Forests to discuss the lack of trained manpower for executing various programs of forestry. The manpower requirement projections clearly showed the dearth of trained manpower in forestry which would continue in the seventh as well as the eighth plans also. It was hence, decided that it would be necessary to step up the forestry education program and the then Inspector General of Forests wrote a letter in this regard to the Director General, ICAR, at the end of January 1985. Subsequently, President, Forest Research Institute, Dehradun had a meeting in February, 1985 with Deputy Director General (Education), ICAR and desired that the ICAR may assist in meeting the manpower needs for forestry programs.

After detailed discussions, it was finally agreed that the State Agricultural
Universities might be requested to establish Departments of Forestry for training and research programs in silviculture, tree improvement and management of forest estates. Accordingly, several SAUs started forestry degree programs. At present, there are 9 Forestry Colleges under ICAR-SAU System offering UG and PG programs in forestry. In addition, there are several general universities offering P.G. Programmes in forestry.
Silviculture and Forest Management

A. Major Courses

A 1. Core Courses 12 Credits

1. Silviculture 1+1
2. Forest Mensuration and Inventory Preparation 1+1
3. Agroforestry 2+0
4. Tree Breeding 2+1
5. Forest Ecology and Biodiversity Conservation 1+1
6. Forest Based Industries 1+0
   Seminar 0+1 1 Credit

A.2 Optional Courses 12 Credits

1. Silvicultural Systems 2+0
2. Forest Nursery and Afforestation Techniques 1+1
3. Forest Regeneration 1+1
4. Forest Productivity 2+0
5. Forest Management 2+0
6. Watershed Management 2+0
7. Range Management 2+0
8. Remote Sensing Techniques in Forestry 2+1

B. Supporting Courses 10 Credits

1. Computer Applications and Information Technology 0+1
2. Remote Sensing and GIS 1+0
3. Forest Policy and Law 1+0
4. Working Plans 1+0
5. Statistical Methods, Design of Experiments and Research Methodology 2+1
6. Forestry Extension, Technology Transfer and Linkage 1+1
7. Wildlife Management 2+1
8. Joint Forest Management 2+1
9. Forest Microbiology 2+1

Any other course(s) as recommended by the student Advisory Committee

Total 35 Credits
A. MAJOR

A.1 CORE COURSES

1. SILVICULTURE


Practical

Study of stand composition and stand structure. Regeneration of species in forests. Silvicultural techniques of important tree species listed above.

Suggested Readings


2. FOREST MENSURATION AND INVENTORY PREPARATION


Practical


Suggested Readings


3. AGROFORESTRY

Farming systems - monoculture, multiple cropping, agro-and farm-forestry. Agroforestry systems - perspectives, classification, national and global

Suggested Readings


4. TREE BREEDING 2+1


Practical


Suggested Readings


5. FOREST ECOLOGY AND BIODIVERSITY CONSERVATION


**Practical**


**Suggested Readings**


**6. FOREST BASED INDUSTRIES**

Industrial raw materials, processing and marketing of paper and pulp, rayon, spices, non-drying and essential oils, fibers and flosses, tans, dyes, gums, resins and other minor forests produce.

**Suggested Readings**


A.2. OPTIONAL COURSES

1. SILVICULTURAL SYSTEMS

Classification, formulation and objectives of silvicultural systems. High forests and coppice systems. Changing concepts in silvicultural systems. Clear felling system and its modifications. Shelter wood system - uniform system, regeneration period, periodic blocks, and group system. Irregular shelter wood system. Selection system - characteristics, rotation, felling cycle. Application in India. Coppice system: simple coppice system, coppice with standards, pollard system. Change of systems, types of conversions, conversion from coppice system to high forest.

Suggested Readings


2. FOREST NURSERY AND AFFORESTATION TECHNIQUES


Practical


Suggested Readings


3. FOREST REGENERATION

Site manipulation by physical, chemical and biological methods. Regeneration in relation to silvicultural systems. Problems regeneration of important conifers (fir, spruce, deodar, chir) and broad leaved species (sandal, sal, teak, terminalias, Alnus, etc.).

Practical


Suggested Readings


4. FOREST PRODUCTIVITY


Suggested Readings


5. FOREST MANAGEMENT


Suggested Readings


6. WATERSHED MANAGEMENT


**Suggested Readings**


**7. RANGE MANAGEMENT**


**Suggested Readings**


Pokhriyal, T.C., Kumar, A., Nautiyal, S. and Naithani, H.B. 1992. *Fodder from*
8. REMOTE SENSING TECHNIQUES IN FORESTRY


Practical

Use of various photogrammetry instruments, basic exercises in orientation, transfer, construction of principle points, recognition and identification of objects on photographs. Compilation of maps and their interpretation.

Suggested Readings


B. SUPPORTING COURSES

1. COMPUTER APPLICATIONS AND INFORMATION TECHNOLOGY

**Hardware**: History and development of computers - Organisation and component parts of computer system - input/output devices - Keyboard, mouse, digitiser, soundcard, videocard - Monitor - Printers - Modem - Scanner.

Memory systems - Main, Auxiliary memory - RAM, ROM - Secondary storage - hard disks - floppy disk drive - CD ROM.


**Software Applications**

**Word Processing**: MS word basics - Formatting text and documents - Headers, footers and tabs - Tables - Sorting, Spelling and grammar checks - Mail merge features - Print controls.

**Spreadsheet facilities**: Excel basics - Cell concepts - Building up worksheets - Functions and formulae - Statistical operations using Excel - Creating charts and graphs - Working with database - Playing, what if.

**SPSS Statistical Package**: Features of SPSS - Data handling and Data management - Statistical functions - Distribution function, File handling and transformation - discriminant analysis - Valuability analysis - Regression and variate analysis - statistical graphics - Forestry related applications.

**Features of Information Technology**: Introduction to information Technology - Basics of computer networking - LAN, WAN - Bus - Tokening - 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."

Computer Hands on Practice:

**Suggested Readings**

CRAW FORD, ABCs of Windows 98, BPB Publications.


MOSELEY, Mastering MS Office, BPB Publications.

Working with Windows, A hands on Tutorial, Tata McGraw Hill.
2. REMOTE SENSING AND GIS


Various platforms for data acquisitions - Aerial photography - Satellite sensors - Optical, Thermal and Microwave - Different types of data products and their characteristics - Satellite data - Acquisition, storage and retrieval - Visual interpretations - Digital image processing.

GPS : introduction - Basic principles - Definition of map - Computer Assisted Cartography - Hardware requirements - Types of data - Spatial and nonspatial data - Raster and Vector data Conversion - GIS analysis and modeling - Digital contour modeling - Errors and elimination of them.


Suggested Readings


NICHOLAS CHRISMAN, Exploring Geographical Information Systems.


3. FOREST POLICY AND LAW

Forest Policy


Forest Law

Study of the salient feature of the following acts:

The Indian Forest Act. 1927 (Act No. 16 of 1927).
The Wildlife (Protection) Act 1972 as amended from time to time.
The Forest (Conservation) Act. 1980 as amended from time to time.

Suggested Readings


4. WORKING PLANS

Definition

Reconnaissance survey and preparation of Reconnaissance Report

Field Work

Enumeration
Growth measurements
Yield regulation
Field work, Stock mapping

Contents of a Working Plan

Part - I Summary of facts on which proposals are made
Chapter I to VIII - the tract dealt with - the forests - utilization of the produce - staff and labour - past systems of management - statistics of growth and yield - wildlife, roads, buildings, wells and other facilities.
Part - II Future management and prescriptions
Chapter - I : Basics of proposals
Chapter - II : One chapter each for every main working circle
Chapter - III : One chapter each for every overlapping working circle
Chapter - IV : Miscellaneous regulations/wildlife
Chapter - V : Establishment and labour
Chapter - VI : Control and records
Chapter - VII : Financial forecasts
Chapter - VIII : Summary of prescriptions
Chapter - IX : Marking rules
Chapter - X : Expenditure on working plan

Appendices
Maps
Glossary of common local terms
Glossary of local and scientific names of plants and animals.

Suggested Reading

5. STATISTICAL METHODS, DESIGN OF EXPERIMENTS AND RESEARCH METHODOLOGY

Basic Statistical Methods in Experimentation

Sampling Techniques in Forestry

Need for sampling in forestry. Complete enumeration Vs partial enumeration. Principal steps in sample surveys, population, sampling unit, size of sample, (sample intensity) bias, accuracy and precision. Sampling variation and estimation of sampling error. Determination of sample size for a given level. Classified sampling design used in forest surveys. Simple random sampling - stratified random sampling. Systematic sampling - Point sampling and use of wedge prism.

Planning of Experiments

Principles of experimental design. Randomization. Layout and analysis of data of Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD), Split Plot and Strip-plot Designs.

Research Methodology

Selection of research problem considering National Forestry Policy - Writing project proposal. Generation of research questions - Stating objectives of research study - Proposing hypothesis - Planning for literature survey - Use of computer - based literature - Planning for field work - Data collection- Statistical Analysis. Interpretation and deriving inference and conclusions - Preparation of thesis/dissertation/research project report - Development of scientific articles for publication.

Practical

Laying out of designs in the filed
i) ABBA,
ii) Latin Square,
iii) Replicated and Randomized design,
iv) Split plot design
v) Scattered block.

Analysis of results of the above design,

Sampling and Enumeration exercises in the field and recording of the data.

Suggested Readings

Forest Extension in India


Innovating Forestry Extension Programs

Extension strategies for updating technology - Planning and implementing extension campaigns - Technology transfer centers - Solving individual and group extension methods - Open for a - Tree Farmers Day.

Developing Forestry Extension

Developments at district level - Organisational design and extension administration - Evaluating extension programs - Inservice training of extension personnel - Planned staff development and demonstration plots in forestry.

Followup of extension - Consultancy - Evaluation of quality and assessment of returns - Marketing the products - Case studies in extension.

Practical

Visit to project tribal village, meeting the villagers for a specific task, practicing the use of Black boards, Flip Charts, O.H.P., Slide Projectors, and VCR.

Preparing skits for A.I.R. broadcast/TV broadcast on specific issues, Organising field demonstration on Nursery, Plantation, Harvesting, Processing, Problem solving through question and answer sessions, laying filed trials
for technology transfer, analysing the reasons for success/failure stories.

**Suggested Readings**


FAO, Planning Forestry Extension Programs, FAO, Bangkok, Thailand.

International Institute of Rural Reconstruction, Agro forestry Technology Information Kit, International Institute of Rural Reconstruction, Silong, Philippines.


Ministry of Food and Agriculture, *(1961)*, Extension Education in Community Development MFA, Government of India, New Delhi.


**7. WILDLIFE MANAGEMENT**

**Introduction**

Definition and concept of wildlife in India - Distribution of wildlife in India - Status of wildlife conservation in India - Essentials of wildlife environment - Need for wildlife protection - Development and Management - Faunal zones in India - Survey of important fauna and flora in India.
Wildlife as a Natural Resource and Land Use

Multiple land use concept. Classification of area used for wildlife purpose - Biosphere reserve - National Parks - Sanctuaries - Gene reserve and closed areas - Classification of wildlife values - Consumptive and non-consumptive uses of wildlife. Wildlife as productive reserve - Wildlife as landed capital - As gene pool.

Wildlife Values

Classification of economic values of wildlife, positive values - Useful products, useful activities, Income from wildlife - Wildlife as tourist attraction.

Biological Base of Wildlife Management

Food : Quantity, quality, food chain, niches, size of food, pinch, period, carrying Capacity, predation.
Shelter : Basic requirements, territory, home range.
Animal Population : Biological surplus, breeding potential, internal adjustment factors, gregariousness and flocking, density and saturation point, population dynamics.

Wildlife Management


Ecology of Wildlife

Distribution and behavior of animals, birds, reptiles as affected by various environmental and instinctive factors.
Zoo - geographical regions of India.
Important animals of India, their distribution and important characteristics, Rare, threatened and endangered species.

Wildlife Studies

Census and estimates, Track and trails, Recognizing kill evidence and Marking

National Parks, Wildlife Sanctuaries and Biosphere Reserves

National Parks, Wildlife Sanctuaries and Biosphere Reserves explained - Safari management - Jungle lodges and tourism - Safety management -

**Special Protection and Development Projects for Endangered Species**

Project Tiger - Gir lion sanctuary project - Crocodile breeding project - Project Hangal, ecology and conservation of Himalayan musk deer - Manipuri brown antlered deer - Wildlife protection Act - Wildlife Education through specific television channels available - The role of animals on forest decomposition processes - Influence of animals on productivity of ecosystem.

**Major Wildlife Management Problems in India**

Major wildlife management problems in India and their probable solutions. Habitat evaluation and mapping - Objectives of captive breeding and rehabilitation - Problems and appropriate solutions.

**Practical**

Enumeration of wildlife, Study of pug marks of wild animals, Preparation of plaster casts of pug marks, Census of herbivores, Observing feeding pattern, food preference of selected herbivores, Visit one National Park or Wildlife Sanctuary in the region and study the wildlife management, Case studies of major wildlife projects in India, and their impact on wildlife, impact of project tiger, and Status of major Zoological Parks in India.

**Suggested Readings**


SAMAR SINGH (1987), Conserving India's Natural Heritage, Natraj Publication, Dehra Dun.


8. JOINT FOREST MANAGEMENT

Concept of Joint Forest Management

Forests as common property resource - Relationship between abutting communities and forests - Abutting communities as stake holders - Involvement of local communities in **upgradation**, protection and management of R.Fs. - Sharing of benefit flows.

**Evolution of Joint Forest Management in India**

Community rights and responsibilities as delineated in Indian Forest Act. 1927 - access to forests, nistar, usufruct rights, community obligation to report thefts and help suppress fires - Fire reward system

**Arabari** (West Bengal) experiment - Sukomajri (Punjab) experiment - Interface forestry of Tamil Nadu.

People's participation as envisaged in National Forest Policy, 1988 - Guidelines on joint forest management issues by Government of India.

**Comparison of Traditional and Joint Forest Management Systems**

Strategy, planning and management - Participation of local communities in knowledge sharing, products emphasis, institution, approach, transparency, species, central concepts and results.

**Creating Stakes for Communities**

Local level user groups
State level user groups

**Factors Favorable for Initiating Joint Forest Management**

Homogeneity of user community - Dependence on forests - Stakes in protection and upgradation - Presence of adequate root - Stock - Forestland/man ratio - Attitude of forest staff and local leadership - Presence of NGO - Tenurial and settlement relationship.

**People's Participation**

Organising local villagers around forest resources - Need for group efforts - Phases in organizing joint forest management groups preparatory phase, group formation phase and stabilisation phase.

Organising village forest councils and Joint Forest Management groups.

**Planning Process**

Baseline survey - Rural social analysis - Natural resources analysis - Planning process - Drafting the micro-plan.
Implementation

Diagnostic reconnaissance - Initiating dialogues - Participatory learning and action exercises - Formation of village forest councils - Preparation of participatory micro-plan for the watershed - Memorandum of understanding - Liaison with line departments/organizations - Involving NGOs - Village development activities - Providing alternate sources of employment - Training of staff and local leaders.

Anticipated Impediments

Conflicts among different groups - Conflicts among different villages - Conflicts between VFC and Panchayats - Political interference - Apathy of implementing officials and local leaders - Conflicts in benefits sharing - Government rules and regulations - Paucity of funds.

Contributory Factors for the Success of Joint Forest Management

Sustained efforts - Sustainable employment opportunities - Adequate benefit flows - Empowerment of VFCs - Augmenting water resources - Fire control - Augmenting fuel and fodder supplies - Organising self help groups.

Human Resource Development


Practical

Visit to a target village in a proposed JFM Watershed and carry out PRA/RDA/PLA Exercises.

Study of the activities of JFM watershed under implementation.
Study the obligation of the forest department and villagers.
Study of benefit sharing mechanism.
Study the formation and composition and functions of village forest council.
Evaluate the JFM practices.
Study the motivational methods adopted for forest staff and village forest council leaders.
Suggested Readings

ANAMALAI, R. (1999), Participatory Learning and Action and Micro Planning for JFM, Dean, SFRC, Coimbatore - 641002, Tamil Nadu.

Joint Forest Management : Concept and Opportunities (1992), Society for promotion of Wasteland Development, Copernicus Marg, New Delhi - 110001.

THINAGARAN, M. (1999), Joint Forest Management in Tamil Nadu, Tamil Nadu Forest Department, Chennai - 600015.

9. FOREST MICROBIOLOGY 2+1

Litterfall - greatest loss of net primary production - greatest in moist, warm. Fertile, high productivity sites - accounts for bulk of N, Cs, Mg. and P. - an important parameter of energy flow to microfauna and flora and influence net primary production - greater turnover of organic matter below ground due to mortality of fine roots, mycorrhial fungi than above ground.

Decomposition of litter and release of nutrients slow or fast - thicker litter and undesirable soil properties - fast decomposition 6 to 10 times faster in tropical than in temperate forests - decomposition and release of nutrients - critical link in biogeochemical cycle.

Decomposition and combined action of soil fauna, flora and microbes - soil mesofauna reducing leaves into tiny bits and improving it as a good substitute for bacteria and fungi - chemical composition of litter, acidity, alkalinity and C/N ratio effect on rate of decomposition - soil microclimate and fertility status of soil effect on litter decomposition- end products CO₂, water, inorganic ions and organic materials.

Soil organic matter - Litter layer (L), intermediate layer (F) and humus layer (M) horizontal layer of forest floor - mor, moder and mull.

Soil Biology

Microflora: bacteria (autotrophic, heterotrophic and symbiotic), actinomycetes, fungi, Mycorrhizae - ectropic and endotropic, algae, Macroflora - plant roots rhizosphere.

Factors affecting depth of root penetration: physical properties of soil, soil moisture and aeration, soil temperature, nutrition, root competition with other roots, soil chemistry.

Soil fauna: Diverse group from large burrowing animals to microscopic mites, nematodes, protozos.
**Macrofauna** (soil vertebrates, **mollusks**, earthworms, larger arthropods) influences soil aeration and structure, soil drainage and soil development.

**Mesofauna** (ants, mites, **springtails, potworms**, nematodes) influence bulk density, predation on bacteria and fungi and parasitism of nematodes.

**Microfauna** (small mites, nematodes) major role in promoting friable crumb structure.

In the final stage, the black amorphous humus as mixture of faecal pellets in all stages of disintegration, fragments of leaf tissue, hyphae, exoskeletons and other chitinized remains of soil animals.

**Importance of organic matter:** storehouse of nutrients, energy sources to micro-organisms, increases infiltration, stabilizes structure against erosion, increases CEC.

**Practical**

Operation of microscope, micrometry sterilization, growth media preparation, Isolation of microorganisms from **rhizosphere** and non-rhizosphere soil:

- Enumeration of microbial population in forest soils,
- Isolation of **symbiotic N2**, fixing bacteria,
- Acetylene reduction assy,
- Organisms involved in nitrification and **denitrification**,
- Phosphors solubilization,
- **Phosphobacteric - Mycorrhiza, Ectomycorrhiza, Endomycorrhiza**,  
- Enumeration of micro-organisms in phyllosphere,
- Relationship of forest soil organisms - Associative relationship of forest soil organisms,
- Antagonism - gust **microflora** of termite, insect pests and earthworms - Microcontrol of forest tree pests - Microbia insecticides.

**Suggested Readings**


Agro forestry and Ecology

A. Major Courses

A 1. Core Courses

1. Silviculture 1+1
2. Forest Mensuration and Inventory Preparation 1+1
3. Agroforestry 2+0
4. Tree Breeding 2+1
5. Forest Ecology and Biodiversity Conservation 1+1
6. Forest Based Industries 1+0

Seminar 0+1 1 Credit

A 2. Optional Courses

1. Social Forestry 2+1
2. Plantation Forestry 2+0
3. Productivity of Agroforestry Systems 2+1
4. Agroforestry for Animal Production 2+0
5. Designing and Modeling in Agroforestry 2+0
6. Forest Ecosystem Dynamics 2+1
7. Watershed Ecology 2+1
8. Forest Fire Ecology 2+1
9. Wildlife Ecology 2+1
10. Ecology of Forest Farming 2+1

B. Supporting Courses

1. Computer Applications and Information Technology 0+1
2. Remote Sensing and GIS 1+0
3. Forest Policy and Law 1+0
4. Working Plans 1+0
5. Statistical Methods, Design of Experiments and Research Methodology 2+1
6. Forestry Extension, Technology Transfer and Linkage 1+1
7. Wildlife Management 2+1
8. Joint Forest Management 2+1
9. Forest Microbiology 2+1

Any other course(s) as recommended by the student Advisory Committee

Total 35 credits
A. MAJOR

A.1 CORE COURSES

Details as given in section on Silviculture and Forest Management

A. 2 OPTIONAL COURSES

1. SOCIAL FORESTRY  
2+1


Practical

Methods of plantation on wastelands. D & D exercises. Visit to social forestry plantations. Visit to forest nurseries.

Suggested Readings


2. PLANTATION FORESTRY


Suggested Readings


3. PRODUCTIVITY OF AGROFORESTRY SYSTEMS

Practical

Methods to estimate productivity of herbs, shrubs and trees. To study the architecture of roots of trees. To measure the canopy of trees and leaf area index. To find out the allelopathic effect of trees.

Suggested Readings


4. AGROFORESTRY FOR ANIMAL PRODUCTION

Importance of silvi - pastoral system vis-a-vis cattle, sheep and goats. Feed and fodder resources in agroforestry systems. Nutrient analysis of forages derived from fodder trees/shrubs. Nutrient requirement for various livestock and their ration computation with agroforestry forages and trees leaves. Forage and tree leaves preservation. Calendar for forage crop production in different agroforestry systems including lopping schedules. Optimization of animal production. Animal products technology and marketing.
Suggested Readings


5. DESIGNING AND MODELING IN AGROFORESTRY

Designing of agroforestry systems experiments on hedgerow, live fences, mixed intercropping, and alley cropping. Elements of modeling, model building, modeling philosophy, validation, sensitivity analysis, statistical decision theory, statistical hypotheses. Introduction to various mathematical techniques for modeling, renewable resources and making management decisions, difference and differential equation models, Leslie matrix model of population growth and simulation.

Suggested Readings


6. FOREST ECOSYSTEM DYNAMICS

Practical

To estimate litter on the forest floor. To analyze the litter for nitrogen. To study decomposition of organic matter by litter bag method.

Suggested Readings


7. WATERSHED ECOLOGY


Practical

Visit to an important watershed project. To study watershed development and management techniques.

Suggested Readings


Dhuruva Narayana, V.V. 1993. Soil and water conservation research in India, ICAR, New Delhi.
Suggested Readings


5. DESIGNING AND MODELING IN AGROFORESTRY

Designing of agroforestry systems experiments on hedgerow, live fences, mixed intercropping, and alley cropping. Elements of modeling, model building, modeling philosophy, validation, sensitivity analysis, statistical decision theory, statistical hypotheses. Introduction to various mathematical techniques for modeling, renewable resources and making management decisions, difference an differential equation models, Leslis matrix model of population growth and simulation.

Suggested Readings


6. FOREST ECOSYSTEM DYNAMICS

Practical

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Suggested Readings


7. WATERSHED ECOLOGY 2+1


Practical

Visit to an important watershed project. To study watershed development and management techniques.

Suggested Readings


Dhuruva Narayana, V.V. 1993. Soil and water conservation research in India, ICAR, New Delhi.


8. FOREST FIRE ECOLOGY

Fire related ecology of dominant species on forest range and habitats. Impact of fire on regeneration and vegetation succession. Effects of fire on soil, nutrient cycling, soil organisms, forest development and wildlife in forests and grasslands. Prescribed burning. Development of fire danger rating systems. Fire detection system. Fire control and suppression procedures in India and developed nations.

Practical


Suggested Readings


9. WILDLIFE ECOLOGY

Practical

Visit to wildlife parks and study the methods of animal counts, and their habitat.

Suggested Readings


10. ECOLOGY OF FOREST FARMING


Practical

To visit important agroforestry systems. To estimate biomass of trees, shrubs and crops. To study ordination of trees in farm forest.

Suggested Readings


**B. SUPPORING COURSES**

Details as **given** in section on Silviculture and Forest Management
### Genetic Resources, Tree Breeding and Biotechnology

#### A. Major Courses

**A.1. Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>1. Silviculture</td>
<td>1+1</td>
</tr>
<tr>
<td>2. Forest Mensuration and Inventory Preparation</td>
<td>1+1</td>
</tr>
<tr>
<td>3. Agroforestry</td>
<td>2+0</td>
</tr>
<tr>
<td>4. Tree Breeding</td>
<td>2+1</td>
</tr>
<tr>
<td>5. Forest Ecology and Biodiversity Conservation</td>
<td>1+1</td>
</tr>
<tr>
<td>6. Forest Based Industries</td>
<td>1+0</td>
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**Seminar**

<table>
<thead>
<tr>
<th>Seminar</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0+1</td>
<td>1 Credit</td>
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**A.2. Optional Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reproductive Systems in Forest Trees</td>
<td>1+1</td>
</tr>
<tr>
<td>2. Breeding Methods in Forest Trees</td>
<td>2+0</td>
</tr>
<tr>
<td>3. Tree Seed Orchards</td>
<td>1+1</td>
</tr>
<tr>
<td>4. Quantitative Genetics in Forest Tree Breeding</td>
<td>2+0</td>
</tr>
<tr>
<td>5. Plant Genetic Diversity and Conservation</td>
<td>2+0</td>
</tr>
<tr>
<td>6. Tree Physiology</td>
<td>2+1</td>
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<tr>
<td>7. Plant Tissue Culture I</td>
<td>2+1</td>
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<tr>
<td>8. Plant Tissue Culture II</td>
<td>1+1</td>
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<tr>
<td>9. Molecular Biology</td>
<td>1+1</td>
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<tr>
<td>10. Plant Genetic Engineering</td>
<td>2+1</td>
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</tbody>
</table>

#### B. Supporting Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Computer Applications and Information Technology</td>
<td>0+1</td>
</tr>
<tr>
<td>2. Remote Sensing and <strong>GIS</strong></td>
<td>1+0</td>
</tr>
<tr>
<td>3. Forest Policy and Law</td>
<td>1+0</td>
</tr>
<tr>
<td>4. Working Plans</td>
<td>1+0</td>
</tr>
<tr>
<td>5. Statistical Methods, Design of Experiments and Research Methodology</td>
<td>2+1</td>
</tr>
<tr>
<td>6. Forestry Extension, Technology Transfer and Linkage</td>
<td>1+1</td>
</tr>
<tr>
<td>7. Wildlife Management</td>
<td>2+1</td>
</tr>
<tr>
<td>8. Joint Forest Management</td>
<td>2+1</td>
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<tr>
<td>9. Forest Microbiology</td>
<td>2+1</td>
</tr>
<tr>
<td>Any other course(s) as recommended by the student Advisory Committee</td>
<td></td>
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**Total**

<table>
<thead>
<tr>
<th>Credits</th>
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<tbody>
<tr>
<td>35 Credits</td>
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</tbody>
</table>
A. MAJOR

A.1 CORE COURSES

Details as given in section on Silviculture and Forest Management

A. 2 OPTIONAL COURSES

1. REPRODUCTIVE SYSTEMS IN FOREST TREES 1+1


Practical


Suggested Readings


2. BREEDING METHODS IN FOREST TREES


Suggested Readings


3. TREE SEED ORCHARDS

Importance of genetically improved seed in plantation forestry. Status of seed production among major plantation species. Short term supply of superior seed: Selection and delineation of seed stands, seed production areas, seed zones, seed ecological zones. Seed orchards: need, functions and purpose. Types of seed orchards: clonal seed, seedling seed, evolving seed, containerized seed, hybrid and research seed, first, second and advanced generation seed. Seed orchard genetics: random mating, gamete exchange and parental balance. Estimation of genetic parameters from seed orchard data. Ortet age and its effect on seed production. Importance of progeny testing. Establishment of seed orchards Selection and preparation of orchard site, isolation, orchard size, and designs. Seed orchard management: rouging Silvicultural practices to increase seed yield. Pest and disease management. Seed collection and record keeping. Seed orchard registration and documentation. Importance of seed orchards in gene conservation.

Practical


Suggested Readings

Young, A., Boshie, B and Boyle, T. 2002. *Forest conservation genetics principles and practices* (Ed.) CABI, Australia.

4. **QUANTITATIVE GENETICS IN FOREST TREE BREEDING**


**Suggested Readings**


[45]


Young, A., Boshie, B and Boyle, T. 2002. *Forest conservation genetics principles and practices (Ed.) CABI,* Australia.


5. PLANT GENETIC DIVERSITY AND CONSERVATION


Suggested Readings


6. TREE PHYSIOLOGY


Practical

Related to the topics described above depending upon the facilities available.

**Suggested Readings**


7. PLANT TISSUE CULTURE - I

Plant tissue culture-principles, history, development, fields of application, progress and prospects with special reference to tree crops. Components and preparation of culture medium. Collection, handling and surface sterilisation of explants. Inoculation and incubation. Culture conditions. Stages of

Practical


Suggested Readings


8. PLANT TISSUE CULTURE - II

Practical


Suggested Readings


9. MOLECULAR BIOLOGY


Practical


Suggested Readings

10. PLANT GENETIC ENGINEERING


Practical


Suggested Readings


**B. SUPPORTING COURSES**

*Details as given* in section on Silviculture and Forest Management
Forest Utilization

A. Major Courses

A 1. Core Courses 12 Credits

1. Silviculture 1+1
2. Forest Mensuration and Inventory Preparation 1+1
3. Agroforestry 2+0
4. Tree Breeding 2+1
5. Forest Ecology and Biodiversity Conservation 1+1
6. Forest Based Industries 1+0

Seminar 0+1 1 Credit

A.2 Optional Courses 12 Credits

1. Wood Anatomy and Identification 1+1
2. Wood Processing 2+0
3. Timber Engineering 2+1
4. Timber Harvesting 1+1
5. Medicinal and Aromatic Plants 1+1
6. Forest Economics 2+0
7. Project Planning and Evaluation 2+1
8. Marketing of Forest Products 2+1
9. Resource Economics 2+0

B. Supporting Courses 10 Credits

1. Computer Applications and Information Technology 0+1
2. Remote Sensing and GIS 1+0
3. Forest Policy and Law 1+0
4. Working Plans 1+0
5. Statistical Methods, Design of Experiments and Research Methodology 2+1
6. Forestry Extension, Technology Transfer and Linkage 1+1
7. Wildlife Management 2+1
8. Joint Forest Management 2+1
9. Forest Microbiology 2+1

Any other course(s) as recommended by the student Advisory Committee

Total 35 credits
A. MAJOR

A.1 CORE COURSES
Details as given in section on Silviculture and Forest Management

A.2 OPTIONAL COURSES

1. WOOD ANATOMY AND IDENTIFICATION 1+1


Practical


Suggested Readings

Trotter, H. 1982. Indian forest utilisation, Forest Research Institute and Colleges, Dehradun.

2. WOOD PROCESSING 2+0

Type of saw machinery. Design and layout of saw mill and wood workshops. Wood water relationship. Wood seasoning - principles, factors influencing drying

Suggested Readings


Trotter, H. 1982. Indian forest utilisation, Forest Research Institute and Colleges, Dehradun.


3. TIMBER ENGINEERING


Practical

4. TIMBER HARVESTING

Objectives: logging variables, stumpage appraisal, accessibility of forest terrains and terrains classification. Stump puller. Principles and practices in felling trees, bucking for higher volume. Production and higher value assortments. Losses in bucking, grades. Principles and operation of skidding and forwarding timber loads on forest, terrains, density of forest roads and skidding distances. Road planning principles unloading and storage: cost calculations. Power logging - logging systems, band saw, winches and machine mounted winches, high lead skidding, multi-span skyline systems, mobile tower yarders, wire rope principles and constructions. Log transportation: by roads, rails, rivers and dragline. Road and hauling carts vehicle, capacity, operating costs, distances, depreciations, limitations, water transportation floating calculations, work study and its application to forestry conditions - method study - work measurements - time study, work specifications. Material handling equipment such as Gibs, pulley blocks and crawlers. Economics: scope, loads design and control. Motion Economy.

Practical

Field experiments related to above topics depending upon the facilities available.

Suggested Readings


**Practical**

Identification of medicinal and aromatic plants and their seeds. Nursery technology. Planting methods and cultural practices of important medicinal and aromatic plants.

**Suggested Readings**


**6. FOREST ECONOMICS**

Nature and scope of forest economics. Importance of forests in national economy. The concepts of demand, derived demand and supply with reference to timber and non-timber forestry outputs. Costs and returns analysis, basics of marginal analysis. Price and output determination under different market situations. Economic analysis of forest production systems. Economics of multiple use. Simulations to solve resource allocation problems, harvest
scheduling and optimal economic rotations. Risk and uncertainty considerations in production and marketing of forest produce. Introduction to welfare economics.

Suggested Readings


7. PROJECT PLANNING AND EVALUATION

Practical Exercises based on above and case studies.

**Suggested Readings**


**8. MARKETING OF FOREST PRODUCTS**


Practical

Appropriate exercises from the above and case studies.
Suggested Readings


9. RESOURCE ECONOMICS


Suggested Readings


**R SUPPOTING COURSES**

Details as given in section on Silviculture and Forest Management
Forest Protection

A. Major Courses

A. 1. Core Courses 12 Credits

1. Silviculture 1+1
2. Forest Mensuration and Inventory Preparation 1+1
3. Agroforestry 2+0
4. Tree Breeding 2+1
5. Forest Ecology and Biodiversity Conservation 1+1
6. Forest Based Industries 1+0

Seminar 0+1 1 Credit

A. 2. Optional Courses 12 Credits

1. Pests of Forest Crops 2+1
2. Insect Systematic 2+2
3. Pests of Forest Seeds 1+1
4. Pests of Felled Trees and Stored Timbers 1+1
5. Research Techniques in Forest Entomology 1+1
6. Fungal and Bacterial Diseases of Trees 1+1
7. Forest Tree Diseases caused by Viruses, Mycoplasma and Nematodes 1+1
8. Bio-degeneration of Wood and Wood Preservation 1+1
9. Research Techniques in Forest Pathology 1+1

B. Supporting Courses 10 Credits

1. Computer Applications and Information Technology 0+1
2. Remote Sensing and GIS 1+0
3. Forest Policy and Law 1+0
4. Working Plans 1+0
5. Statistical Methods, Design of Experiments and Research Methodology 2+1
6. Forestry Extension, Technology Transfer and Linkage 1+1
7. Wildlife Management 2+1
8. Joint Forest Management 2+1
9. Forest Microbiology 2+1

Any other course(s) as recommended by the student Advisory Committee

Total 35 Credits
A. MAJOR

A. 1 CORE COURSES
Details as given in section on Silviculture and Forest Management

A. 2 OPTIONAL COURSES

1. PESTS OF FOREST CROPS  2+1

Status, distribution, bio-ecology, economic threshold level and management strategies of important insect and mite pests in economically important stands like teak, sandal, Eucalyptus, Casuarina, Terminalia, mohagany, sal, tamarind, bamboos, Acacia, Cassia, Dalbergia, canes, Ailanthus, Gmelina, neem, tropical pines, Pinus ssp., Grewia ssp. and deodar. Insect pests of seeds, seedlings, freshly felled trees, dry wood and finished timbers.

Practical

Collection of major insect pests of forest trees, assessment of economic losses due to pests of seeds, seedlings, natural forests and plantations through analytical methods. Study of damage symptoms and nature of damage on economically important trees. Rearing of five major pests and preserving their developmental stages. Visits to different forest nurseries, natural and artificial plantations.

Suggested Readings


2. INSECT SYSTEMATIC  2+2

Neuropteran larvae with families occurring in India. Coleoptera, upto family level. Strepsiptera and Mecoptera, Trichoptera, Siphonoptera, Diptera, Lepidoptera. Classification of Lepidoptera upto family level, including larval lepidoptera, Hymenoptera. Characters used in classification of Hymenoptera upto family level.

Practical

 Techniques of collection, pinning, setting, etc. Visit to various habitats for collection and study of insect eggs. Identification of different nymphs by using keys. Types of larvae and pupae and their identification of different insect adult forms of class covering all orders. Collections of insects belonging to representative families. Visit to nearby ecosystems for collection of Insects.

Suggested Readings


3. PESTS OF FOREST SEEDS


Practical

 Identification of damage to seeds by insects. Collection and study of infested seeds and estimation of damage. Study of insect pests of seeds of tree species. Effect of seed pests on germination and seedling growth.

Suggested Readings


4. PESTS OF FELLED TREES AND STORED TIMBERS

Introduction, pest status, nature and extent of damage by insects on felled

**Practical**

Study of damage symptoms, nature of damage by bark borers and wood borers. Study of different species of insect pests of felled and stored timbers. Visits to natural forests, plantations, wood timber depots and saw mills.

**Suggested Readings**


**5. RESEARCH TECHNIQUES IN FOREST ENTOMOLOGY 1+1**


**Practical**


**Suggested Readings**


**6. FUNGAL AND BACTERIAL DISEASES OF TREES 1+1**

Importance of fungal diseases in forest nurseries and plantations, and

**Practical**

Symptoms of important diseases, isolation of fungi and bacteria and proving Koch's postulates. Preparation of mass culture for soil borne pathogens. Screening techniques to identify resistant sources against important diseases. Multiplication of biocontrol agents and their application. In-vitro evaluation of bio-control agents against fungal and bacterial pathogens. Spore trap studies to estimate pathogen population. Epidemiology of important tree diseases. Fungicides and their formulations used in disease control. Visit to nurseries and plantations to acquaint with diseases and collection of disease specimens. Screening, characterization and multiplication of important mycorrhizal fungi.

**Suggested Readings**


7. **FOREST TREE DISEASES CAUSED BY VIRUSES, MYCOPLASMA AND NEMATODES**

Historical background, transmission and multiplication of plant viruses. Symptoms of viral infections, effects of plant viruses on host physiology, epidemiology of tree virus diseases, important virus diseases of trees and their management. Historical background of Phytoplasma, Spiroplasma, *Rickettsia* like organism, flagellated Protozoa and *Bacteria* like organisms causing tree diseases, morphological and biochemical characteristics of these organisms.
Symptoms, transmission, multiplication and epidemiology of these diseases. Effects on host physiology. Important diseases caused by them and their management. Historical background of plant parasitic nematodes, morphological characteristics and symptoms produced by them. Important diseases caused by them and their management.

**Practical**

Symptoms of diseases caused by viruses, transmission of plant viruses, purification, detection of plant viruses, symptoms of diseases caused by phytoplasma, Spiroplasma, rickettsia like organisms, bacteria like organisms and flagellated protozoans, their detection, their transmission, symptoms of diseases caused by plant parasitic nematodes, their extraction methods from soil and infected plant tissues. Visit to plantations and natural forests to acquaint with diseases and collection of diseased specimens.

**Suggested Readings**


**8. BIODEGRADATION OF WOOD AND WOOD PRESERVATION**


**Practical**

depots to acquaint with different types of decay and to collect fungi associated with decay.

Suggested Readings


9. RESEARCH TECHNIQUES IN FOREST PATHOLOGY

Importance of Forest Pathology. Important equipments/instruments used in Forest Pathology and their working principles. Methodology of screening progenies of tree species against pathogens and specific toxins. *In vitro* screening of fungicides, plant extracts and bio-agents against important pathogens. Practical applications of fungicides in diseases control. Use of aerial photography, satellite imagery knowledge to record the data on disease incidence of trees. Collection of literature, methodology adopted, recording data and interpretation of results. Important periodicals available in the world and India on Forestry and Forest Pathology. Procedures to refer these periodicals. Computer application in developing forecasting models for some important diseases using weather data.

Practical

Acquaintance with different equipments used in forest pathology. Collection and interpretation of data of Forest Pathology. Developing forecasting models for tree diseases using weather data. Developing disease rating scales and standard area diagrams for foliar diseases. *Isozyme* and toxin extraction from pathogens for biochemical estimations. Extraction of phytoalexins from resistant species. Herbaria and culture collections for important tree diseases. Preparation of semi-permanent slides of some important tree pathogens.

Suggested Readings


B. SUPPOTING COURSES
Details as given in section on Silviculture and Forest Management
Annexure - I

BROAD SUBJECT MATTER AREA COMMITTEE MEMBERS FOR FORESTRY

1. Dr P.K.Khosla, Vice-Chancellor, HPKV, Palampur

2. Dr. R. S. Dhanda, Professor, Department of Forestry & Natural Resources, PAU, Ludhiana

3. Dr. R. N. Sehgal, Head, Department of Tree Improvement, UHF, Nauni, Solan.

4. Dr. A. M. Chandrashekhariah, Director Instruction, UAS, Sirsi Campus.

5. Dr. O. P. Toky, Professor, Department of Forestry, CCS HAU, Hisar

6. Dr. Sunil Puri, Head, Department of Forestry, IGAU, Raipur (M.P.)

7. Dr. B. S. Nadagoudar, Senior Scientist - Agroforestry, UAS, Dharwad
Annexure - II

LIST OF PARTICIPANTS IN DIFFERENT MEETIMG-CUM-WORKSHOPS FOR RESTRUCTURING THE COURSE CURRICULA AND SYLLABI IN MASTER DEGREE PROGRAM ON FORESTRY

(1) Meeting held at NAAS office, New Delhi on 7-8, July 1999
1. Dr. P.K. Khosla, VC, HPKW, Palampur
2. Dr. S.L. Mehta, D.D.G. (Education)
3. Dr. N.L Maurya, A.D.G. (Acdn.)
4. Dr. Kirti Singh, Secretary, NAAS
5. Dr. P.L. Gautam, Director, NBPRG, New Delhi, Invite
6. Dr. P.S. Pathak, A.D.G. (agro forestry), Invitee
7. Dr. B.S. Nadagoudar, Member, B.S.M.A.Committee
8. Dr. R.S. Dhandha, Member, B.S.M.A.Committee
9. Dr. R.N. Sehgal, Member, B.S.M.A.Committee
10. Dr. H.K. Singh, Ex-Head, Agronomy Division,
11. Dr. Subhash Chander, Director, ICAR,

(2) Meeting-cum-workshop held at UAS, Dharwad on 5th and 6th April, 2000
1. Dr. P.K. Khosla, Chairman, B.S.M.A.Committee
2. Dr. A.M. Chandrashekharaiah, Member, BSMAC, Director of Instruction (Forestry) University of Agricultural Sciences, Dharwad - Sirsi Campus.
3. Dr. B.S. Nadagoudar, Member, BSMAC, University of Agricultural Sciences, Dharwad.
4. Dr. O.P. Toky, Member, BSMAC, Professor of Forestry, HAU, Hissar.
5. Dr. Sunil Puri, Member, BSMAC, Professor & Head, IGAU, Raipur, M.P.
6. Dr. R.S. Dhandha, Member, BSMAC, Professor of Forestry, PAU, Ludhiana.
7. Dr. R.N. Sehgal, Member, BSMAC, Professor 85 Head, Deptt. of Tree Improvement, University of Horticulture and Forestry, Nauni, Solan, H.P.
8. Dr. V.K. Gupta, Dean, P.G.Studies, HPKW, Palampur.
9. Dr. A.C. Kapoor, Dean, College of Basic Sciences, HPKW, Palampur.
10. Dr. R.P. Singh, Professor & Head, Forestry Department, Kumaon University, Nainital.
11. Dr. S.K. Patil, Professor Forest Utilization, College of Forestry, Sirsi.
12. Dr. S.T. Naik, Professor & Head, Forest Protection, College of Forestry, Sirsi.
13. Dr. S.L. Madiwalan, Professor of Agroforestry, College of Forestry, Sirsi.
14. Dr. K.R. Devar, Professor & Head, College of Forestry
15. Dr. Prasad Kumar, Assistant Professor, College of Forestry, Sirsi, UAS, Dharwad.
16. Dr. R. Vasudeva, Assistant Professor (Forest Biology), CoF, Sirsi, UAS, Dharwad.
17. Dr. S. Mutanel, Scientist S-I, CoF, Sirsi, UAS, Dharwad.
18. Dr. S.T. Kajjidoni, Associate Professor, College of Forestry, Sirsi.
19. Dr. H. Shivana, Associate Professor, College of Forestry
20. Dr. S.J. Patil, Associate Professor Agro forestry, College of Forestry, Sirsi.

(3) Meeting held at H.P.K.V.V., Palampur from 2-4th June 2000.

1. Dr. P.K. Khosla, Chairman, B.S.M.A. Committee and Vice-Chancellor, HPKV, Palampur.
2. Dr. R.S. Dhanda, Member, B.S.M.A. Committee.
3. Dr. V.K. Gupta, Dean, PGS, HPKW, Palampur. Invitee
4. Dr. Atul, Head, Department of Agroforestry, HPKW, Palampur as Nodal Officer.
5. Dr. O.P. Toky, Professor, Department of Forestry, CCS, Hisar and Member, BSMA Committee

(4) Meeting held at Punjab Agricultural University, Ludhiana from 21-23rd June, 2000

1. Dr. P.K. Khosla, Chairman, B.S.M.A. Committee
2. Dr. R.N. Sehgal, Member, B.S.M.A. Committee
3. Dr. R.S. Dhanda, Member, B.S.M.A. Committee

(5) Meeting held at ICFRE, Dehradun on 24 February 2001

1. Prof. P.K. Khosla, Vice-Chancellor, H.P.K.V.V., Palampur
2. Sh. R.P.S. Katwal, Director General, ICFRE, Dehradun
3. Dr. V.N. Sharda, Director, CSWCRT, Dehradun
4. Dr. A.M. Chandrasekhiya, Director of Inst. (FOR), COF, SIRSI (Karnataka)
5. Prof. O.P. Toky, Professor, HAU, Hisar
6. Dr. Sunil Puri, Professor and Head, IGAU, Raipur
7. Dr. P. Kaushal, Coordinator, NAEB, UHF, Solan
8. Dr. R.N. Sehgal, Professor and Head, UHF, Nauni
9. Dr. B.S. Nadagoudar, Director of Extension, UAS Dharwad,
10. Dr. R.S. Dhanda, Professor of Forestry, PAU Ludhiana
11. Dr. A.K. Wahal, Ex-D.D.G. (Edu)., ICFRE, Dehradun
12. Dr. D. Kumar Singh, ADG, ICFRE, Dehradun
13. Dr. Ajay Kumar Lal, Associate Professor, IGNFA Dehradun
14. Dr. S.D. Arora, Registrar, FRI Dehradun
15. Dr. Padu Bahl, Conservator of Forest, NWFP
16. Dr. Mohinder Pal, Head, Botany Division, FRI Dehradun
17. Dr. K.K. Sharma, Scientist SF and CTA( Agrof.) ,ICFRE, Dehradun
18. Dr. Pratap Singh, ADG (Edu), ICFRE, Dehradun
19. Dr. R.M. Singhal, DDG (Edu), ICRE Dehradun
20. Dr. Gopa Pandey, Professor, IGNFA, Dehradun
21. Dr. Atul, Head, Agroforestry Department, HPKVV, Palampur
### Annexure HI

Common Academic **Regulations for Post Graduate Education** in SAUs, DUs and CAU

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particulars</th>
<th>Master's Degree</th>
<th>Doctoral Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>1.</td>
<td>System of Education</td>
<td>Semester</td>
<td>Semester</td>
</tr>
<tr>
<td>2.</td>
<td>Semester duration</td>
<td>110 working days including exam days</td>
<td>110 working <strong>days</strong> including examination days</td>
</tr>
<tr>
<td>3.</td>
<td>Duration of the program</td>
<td>(1) Minimum</td>
<td>(2) Maximum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Semesters</td>
<td>6 Semesters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) Academic Years</td>
<td>(6) Academic Years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 Semesters</td>
<td>12 Semesters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4) Academic Years</td>
<td>6 Semesters</td>
</tr>
<tr>
<td>4.</td>
<td>Eligibility for admission</td>
<td>(1) Bachelor's degree in respective/related subjects</td>
<td>(1) Master's degree in respective/related subjects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) 7.0/10 or equivalent OGPA/equivalent percentage of marks at Bachelor's degree</td>
<td>(2) 7.0/10 or equivalent OGPA/equivalent percentage of marks at <strong>Master's subjects</strong></td>
</tr>
<tr>
<td></td>
<td>Weightage</td>
<td>(i) Entrance - 60%</td>
<td>(i) Entrance - 60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) Undergraduate - 20%</td>
<td>(ii) Master's degree - 30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iii) 12th standard - 10%</td>
<td>(iii) Bachelor's degree - 10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iv) 10 standard - 10%</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Minimum credit requirement</td>
<td>(1) Course work Major*</td>
<td>20-25 Credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10-15 Credits</td>
<td>10-15 Credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Support (outside discipline) Sub Total</td>
<td>35 Credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25 Credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) Thesis</td>
<td>15 Credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>45 Credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>50 Credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70 Credits</td>
</tr>
</tbody>
</table>

*1. Core courses to the extent of 9-12 credits for Masters and 3-5 credits for Doctoral programs have to be taken up out of major courses.*
<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>Permissible work load</td>
<td>15 Credits/Semester</td>
<td></td>
<td>15 Credits/Semester</td>
</tr>
<tr>
<td>8.</td>
<td>Attendance requirement</td>
<td>80%</td>
<td></td>
<td>80%</td>
</tr>
<tr>
<td>9.</td>
<td>Advisory Committee</td>
<td>3 Members (Minimum) (2 from major area including Chairman and one from supporting areas)</td>
<td></td>
<td>4 Members (Minimum) (3 from major area including Chairman and one from Supporting areas)</td>
</tr>
<tr>
<td>10.</td>
<td>Examination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) Course Work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) Core courses Final theory</td>
<td>External</td>
<td></td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>(ii) Remaining</td>
<td>Internal</td>
<td></td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>(2) Comprehensive qualifying examination (after completion of 75% of Major and Supporting Courses separately)</td>
<td>Written</td>
<td></td>
<td>Written</td>
</tr>
<tr>
<td></td>
<td>(i) Question paper setting</td>
<td>External</td>
<td></td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>(ii) Evaluation</td>
<td>Internal</td>
<td></td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>(iii) Viva-voce</td>
<td>Internal</td>
<td></td>
<td>Internal</td>
</tr>
<tr>
<td>(3)</td>
<td>Research and Thesis **</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) Evaluation</td>
<td>External - 1 Examiner</td>
<td></td>
<td>External - 2 Examiners Advisory Committee with one External Examiner</td>
</tr>
<tr>
<td></td>
<td>(ii) Viva-Voce</td>
<td>Internal - Advisory Committee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Grading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) Scale</td>
<td>10 Points</td>
<td></td>
<td>10 Points</td>
</tr>
<tr>
<td></td>
<td>(2) Minimum Passing Grade in a course</td>
<td>6.0 Points</td>
<td></td>
<td>6.0 Points</td>
</tr>
<tr>
<td></td>
<td>(3) Minimum OGPA to obtain degree</td>
<td>6.5 Points</td>
<td></td>
<td>6.5 Points</td>
</tr>
</tbody>
</table>

** 1. To be graded as Satisfactory (S) or Unsatisfactory (US)
2. Ph.D. students should write and submit two research papers on their research work in reputed journals before submitting the thesis.

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