THE ASSAM
ROYAL GLOBAL UNIVERSITY
GUWAHATI

Royal School of Life Sciences (RSLSC)

Department Of Forestry

Course Structure & Syllabus
(Based on NEP-2020)

B.Sc. Forestry
(4-years Single Major)

W.E.F.
AY-2024-25

Semester-I
Paper I/Subject Name: Forest Ecology **Course Code: Major Subject Code: M101** **L-T-P-C- 2-1-0-3** **Credit Units: 3** **Scheme of Evaluation: Theory**

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

Course Outcomes:

On completion of the course the students will be able to:

Course Outcome	Course Outcome	Bloom's Taxonomy Level
CO 1	Basic knowledge on the biomes of the world and the characteristics of temperate and tropical forests. The students will also be able to learn the various definitions of forest and the methods of classification of forests.	BT 1
CO 2	Understand history and development of Indian forestry, branches of forestry and systems of classification of forest types.	BT 2
CO 3	Awareness on importance of forests and the threats faced by forests including global climate change.	BT 3
CO 4	Basic skills in measurement of biodiversity of an area and acquaintance with biodiversity register	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course content	Periods
I	Forestry – definition, history and development of Indian Forestry. Branches of Forestry and their relationships. Major Forest ecosystem, forest environment, major abiotic and biotic components and their interaction.	**14**
II	Trophic levels: food chains, food webs, ecological pyramids and energy flow. Population ecology: population dynamics and carrying capacity, life table and its importance in forest management, nutrient cycling.	**14**
III	Community ecology: species interactions. Ecological succession: theories of succession, climax vegetation types; Forest management and succession; Biogeography.	**14**
IV	Autecology of important tree species, perturbation ecology. Biodiversity and conservation: distribution of diversity in different life forms, biodiversity hotspots, diversity measurement and diversity indices. Principles of conservation biology, Ex-situ and In-situ conservation, genetic and evolutionary principles in conservation; Biosphere concept, conservation efforts in India and worldwide.	**22**

Total	64

Credit Distribution		
Lecture/ Tutorial	**Practicum**	**EL**
60 hrs	**-**	**30 hrs**
		Field work, Assignment, Reflective thinking, case study, seminar, quiz

Textbooks:

1. Ambasht, R.S. and Ambasht, N.K (2008). A Text Book of Plant Ecology. CBS Publishers and Distibutors. New Delhi, India.
2. Frankel, O.H., Brown, A.H.D., Burdon, J.J. (1995). The Conservation of Plant Biodiversity. Cambridge University Press. Cambridge.

References:

4. Misra, R. and Puri, G.S. (2013). Indian Manual of Plant Ecology. Scientific Publishers, Jodhpur, India.
5. Misra, K.C. (1991). Manual of Plant Ecology. Oxford and IBH Publishing Company, New Delhi.
6. Montagnini, F. and Jordan, C.F. (2005). Tropical Forest Ecology: The Basis for Conservation and Management. Springer.
7. Odum, E.P. (1996). Fundamentals of Ecology. Natraj Publishers, Dehra dun, India

Semester-I
Paper I/Subject Name: Forest Ecology (Practical)
Course Code: Major Subject Code: M111
L-T-P-C- 0-0-6-3
Credit Units: 3
Scheme of Evaluation: Theory

Course Objective: To provide hands on to study forest succession, diversity of organism in a forest ecosystem and the treats to this ecosystem.

Course Outcomes:

On completion of the course the students will be able to:

Course Outcome	Course Outcome	Bloom's Taxonomy Level
CO 1	Know different forest types in India and their composition	BT 1
CO 2	Study the composition of forest soil and the microclimatic conditions	BT 2
CO 3	Understand the different threats to forest ecosystem, and also the students will able to understand population dynamics.	BT 3
CO 4	Recognize the composition of a forest ecosystem and study the	BT 4

	succession in the field.	

Detailed syllabus:

Modules	Topics (if applicable) & Course content	Periods
I	1. Visit a forest area, identify the forest type(s) and study the forest composition 2. Survey the trees/butterflies/birds of the campus and workout diversity indices viz. Simpson's Index, Shannon-Weiner Index, Berger Parker Dominance Index and Similarity indices. 3. Visit minimum five home gardens and prepare a model biodiversity register and to document the associated traditional knowledge.	16
II	1. Estimating productivity of a site. 2. Study of microclimate and forest soils. 3. Study of ecological modifications of leaves.	14
III	1. Effects of fire on forest ecosystem 2. Study of population dynamics using model systems 3. Preparation of life tables 4. Study of spatial dispersion among plants	14
IV	1. Study of Forest composition 2. Study of succession in field/water bodies. 3. Visit to different ecosystems.	22
Total		**64**

Credit Distribution		
Lecture/ Tutorial	**Practicum**	**EL**
-	**90 hrs**	**-**
		-

Textbooks:

1. Michael, P. (1984). Ecological Methods for Field and Laboratory Investigations. Tata McGraw-Hill Publishing Company, New Delhi.

Semester-I
Paper I/Subject Name: Basics of Forest Ecology **Course Code: Major Subject Code: N101** **L-T-P-C- 2-1-0-3** **Credit Units: 3** **Scheme of Evaluation: Theory**

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

Course Outcomes:

On completion of the course the students will be able to:

Course Outcome	Course Outcome	Bloom's Taxonomy Level
CO 1	Basic knowledge on the biomes of the world and the characteristics of temperate and tropical forests. The students will also be able to learn the various definitions of forest and the methods of classification of forests.	BT 1
CO 2	Understand history and development of Indian forestry, branches of forestry and systems of classification of forest types.	BT 2
CO 3	Awareness on importance of forests and the threats faced by forests including global climate change.	BT 3
CO 4	Basic skills in measurement of biodiversity of an area and acquaintance with biodiversity register	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course content	Periods
I	Forestry – definition, history and development of Indian Forestry. Branches of Forestry and their relationships. Major Forest ecosystem in NE India, forest environment, major abiotic and biotic components and their interaction in forest ecosystem.	**16**
II	Trophic levels: food chains, food webs, ecological pyramids and energy flow in forest ecosystem. Population ecology: population dynamics and carrying capacity.	**16**
III	Community ecology: species interactions. Ecological succession: theories of succession, climax vegetation types; Biogeography.	**16**
IV	Biodiversity and conservation: distribution of diversity in different life forms, biodiversity hotspots, diversity measurement and diversity indices. Principles of conservation biology, Ex-situ and In-situ conservation.	**16**
Total		**64**

Lecture/ Tutorial	Practicum	EL
60 hrs	**-**	**30 hrs**
		Field work, Assignment, Reflective thinking, case study, seminar, quiz

Textbooks:

1. Ambasht, R.S. and Ambasht, N.K (2008). A Text Book of Plant Ecology. CBS Publishers and Distibutors. New Delhi, India.
2. Frankel, O.H., Brown, A.H.D., Burdon, J.J. (1995). The Conservation of Plant Biodiversity. Cambridge University Press. Cambridge.

References:

1. Misra, R. and Puri, G.S. (2013). Indian Manual of Plant Ecology. Scientific Publishers, Jodhpur, India.
2. Misra, K.C. (1991). Manual of Plant Ecology. Oxford and IBH Publishing Company, New

Semester-I
SEC: PLANT DISEASE IDENTIFICATION AND CONTROL
Subject Code: BOT142S121 L-T-P-C: 0-0-3-3,
Credit Units: 03
SCHEME OF EVALUATION: Practical (P)

Course objective: To introduce and develop basic concepts to the world of plant disease focusing on the management and control of pathogens and epidemics.

Learning Outcomes: After the successful completion of the course the students will be able to:

CO1	To **describe and identify** the physical dimensions, forms, functions and habitats of pathogens	**BT 2 and BT 3**
CO2	To **experiment with different** plant diseases in different crops	**BT 3**
CO3	To **examine and infer** from the studied specimen the type and its management of the disease in the plant kingdom	**BT 4**

Detailed Syllabus

Module	Course content	Lecture Hours
I	Plant disease introduction**:** Terms and concepts; Symptomology and identification of fungal, viral and bacterial plant diseases. Host-Pathogen relationships; Disease cycle and role of environment in disease development; prevention and control of plant diseases. Quarantine and its significance in control of plant diseases.	**15**

II	Major epidemics and their social impacts. Legislative, cultural, and biological protection measures of plant diseases. Koch's postulates. Factors influencing infection,colonization, and development of symptoms.	**15**
III	**Laboratory and Analytical Techniques** Preparation and sterilization of common media. Methods of isolation of plant pathogens andtheir identification. Preservation of microorganisms by pure culture method. Methods of inoculation. Detection and Diagnosis of pathogens in seeds and other planting materials.	**15**
IV	Collection and study of Fungal, Bacterial and Viral Diseases of Crop Plants Project on Management and control of Plant diseases	
	Total	**60**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	**PRACTICALS**	**EXPERIENTIAL LEARNING**
00	60	30 FIELD VISITS, SAMPLE COLLECTION, SUBMISSION

TEXT BOOKS:

1. Paul Khurana, S. M. 2009: Pathological Problems of Economic crop plants and their management.
2. Dubey, R.C. and Maheshwari, D.K. (1999). A text book of Microbiology, S. Chand & Company Ltd.,New Delhi, India

REFERENCE BOOKS:

1. Pelczar, M.J. Microbiology. 2005.Tata McGraw-Hill Co, New Delhi
2. Planke, J. E. Vander. (2013) Plant Diseases Epidemics and control.
3. Sinclair W.A. and H.H. Lyon. Diseases of Trees and Shrubs. 2005. Cornell University Press.
4. Webster J and Weber R.W.S. Introduction to Fungi. 2007. Cambridge University Press.
5. Lucas J.A. Plant Pathology and Plant Pathogens. 2011. John Wiley and Sons Ltd.
6. Williamson VM, Kumar A (2006) Nematode resistance in plants: the battle underground. Trends inGenetics 22: 396–403.

Semester-II
Paper I/Subject Name: Forest Systematics and Ethnobiology **Course Code: Major Subject Code: M201** **L-T-P-C- 2-2-0-3** **Credit Units: 3**

Scheme of Evaluation: Theory

Course Objective: The course is designed to provide basic knowledge of taxonomy in relation to forest and also to familiarize then with ethnomedicinal plants and animals and their traditional use in health care systems.

Course Outcomes:

On completion of the course the students will be able to:

Course Outcome	Course Outcome	Bloom's Taxonomy Level
CO 1	Acquaintance about the forest Systematics and Ethnobiology and significance of ethnobotany and ethnozoology in NE India.	BT 1
CO 2	To familiarize with taxonomic research in India.	BT 2
CO 3	To provide information related to characterization and economic importance of different families of dicot and monocot plants.	BT 3
CO 4	Develop basic methodologies of ethnobiology and to understand the role of plants and animals in health care and drug discovery	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course content	Periods
I	Principles of Systematics (taxonomy), Systems of classifications; Post Darwinian systematics; Concept of species and genera; Modern trends in Taxonomy, Biosystematics & Numerical Taxonomy; Phenetic, Cladistic, Omega and Alpha taxonomy; Role of taxonomy in management and conservation of forest.	**16**
II	Concept of characters; Botanical keys, their use and construction; Principles of plant nomenclature; Concept of ICBN, Typification; Principle of Priority; Valid publication, Naming of new taxon; Taxonomic literature: Classical literatures, Icons, Flora, Revision and Monograph, Taxonomic research in India, Botanical survey of India, Herbaria of India and abroad.	**16**
III	Characterization and Economic importance of selected order and Families of Dicots and Monocots I: Ranales (Magnoliaceae & Annonaceae), Guttiferales (Clusiaceae & Dipterocarpaceae), Malvales (Malvaceae & Sterculiaceae), Ruttales (Rutaceae & Meliaceae), Rosales (Rosaceae & Leguminosae), Myrtales (Combretaceae & Myrtaceae), Rubiales (Rubiaceae), Verbenales (Verbenaceae), Asterales (Asteraceae), Unisexuales (Euphorbiaceae & Moraceae), Orchidales (Orchidaceae), Palmales (Arecaceae), Poales (Poaceae)	**16**
IV	Scope, objectives and methodologies of ethnobiology (Ethnobotany and Ethnozoology); Ethnobotany in relation to health care and drug discovery (Ethnomedicine & Ethnopharmacology), Contribution of wildlife products to human welfare; Hunting of wildlife; Importance and prospects of Ethnobiological studies in North Eastern India.	**16**
Total		**64**

Credit Distribution

Lecture/ Tutorial	Practicum	EL
60 hrs	-	30 hrs
		Field work, Assignment, Reflective thinking, case study, seminar, quiz

Textbooks:

1. A Text Book of Forest Taxonomy, MP Singh, MP Nayar& RP Ray, Amol Publication, New Delhi, 1994.
2. An Introduction to Plant Taxonomy, C. Jeffery, Cambridge University Press, Cambridge, 1982.
3. Plant Taxonomy – O.P. Sharma, Tata Mac Graw Hill, New Delhi, 1993.
4. Taxonomy of Angiosperms Nair R. Publisher: Aph Publishing Corporation. 2010
5. Plant Taxonomy: Advances and Relevance, 1st Edition: A. K. Pandey, et al. CBS Publisher; 2010

References:

1. Plant Taxonomy and Biosystematics, C. A. Stace, Edward Arnold, London, 1989.
2. Introduction to the Principle of Taxonomy, V.V. Sivarajan, edited by N. K. P. Robson, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Calcutta.
3. Ethnobotany-Gary J. Martyn, Chapman& Hall, London,1995.

Semester-II
Paper I/Subject Name: Forest Systematics and Ethnobiology (Practical) **Course Code: Major Subject Code: M211** **L-T-P-C- 0-0-6-3** **Credit Units: 3** **Scheme of Evaluation: Theory**

Course Objective: To provide hands for herbarium collection and its preservation, to have better knowledge about plants plants with ethnomedicinal importance, their documentation and classification.

Course Outcomes:

On completion of the course the students will be able to:

Course Outcome	Course Outcome	Bloom's Taxonomy Level
CO 1	To prepare herbarium with fair knowledge of herbarium preparation techniques	BT 1
CO 2	To understand the various techniques and field practices of ethnobotany and ethnozoology	BT 2
CO 3	To determine the importance value Index (IVI) of traditionally used medicinal plants	BT 3
CO 4	Comprehend the major ethnomedicinal plants used in NE India and their purpose of use.	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course content	Periods
I	1. Plant collection and Herbarium Technique. 2. Survey, collection and identification of tree flora Phytography (description of	16

	plants) and identification of the family, genus and species with the help of Taxonomic literature (Flora etc.). 3. Techniques for preparation of herbarium and submission of minimum twenty herbarium specimens.	
II	1. Preparation of field note book pertinent to floristic study. 2. Methods and field practices of Ethnobotany and ethnozoology. 3. Collection and preservation of traditionally used dead biological samples.	**16**
III	1. Preparation of Keys for the trees of campus/botanical garden 2. Spot characters and floral features of families-Annonaceae 3. Determination of Importance Value Index of Plant Species/Ethnomedicinal herbs	**16**
IV	1. To visit botanical garden/herbal garden/medicinal plant repositories for the identification of ethnomedicinal plants 2. To study the major ethnomedicinal plants and practices followed in NE India 3. To study morphological description and identification of various medicinal plants.	**16**
Total		**64**

Credit Distribution		
Lecture/ Tutorial	**Practicum**	**EL**
-	**90 hrs**	**-**
		-

Textbooks:

1. Plant Taxonomy & Embryology (With Practical Manual)- Satish Kumar, India
2. Methods and Approaches in Ethnobotany – SK Jain (Ed). SEB, Lucknow.

Semester-II
Paper I/Subject Name: Forest Taxonomy and Ethnobiology **Course Code: Major Subject Code: N201** **L-T-P-C- 2-1-0-3** **Credit Units: 3** **Scheme of Evaluation: Theory**

Course Objective: The course is designed to provide basic knowledge of taxonomy in relation to forest and also to familiarize then with ethnomedicinal plants and animals and their traditional use in health care systems.

Course Outcomes:
On completion of the course the students will be able to:

Course Outcome	Course Outcome	Bloom's Taxonomy Level
CO 1	Acquaintance about the forest taxonomy and Ethnobiology and significance of ethnobotany and ethnozoology in NE India.	BT 1
CO 2	To familiarize with taxonomic research in India.	BT 2
CO 3	To provide information related to characterization and economic importance of different families of dicot and monocot plants.	BT 3
CO 4	Develop basic methodologies of ethnobiology and to understand the role of plants and animals in health care and drug discovery	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course content	Periods
I	Concept of species and genera; Modern trends in Taxonomy, Biosystematics & Numerical Taxonomy; Phenetic, Cladistic, Omega and Alpha taxonomy; Role of taxonomy in management and conservation of forest.	**16**
II	Concept of characters; Botanical keys, their use and construction; Principles of plant nomenclature; Concept of ICBN, Typification; Principle of Priority; Valid publication, Naming of new taxon.	**16**
III	Characterization and Economic importance of selected order and Families of Dicots and Monocots: Ranales (Magnoliaceae & Annonaceae), Guttiferales (Clusiaceae & Dipterocarpaceae), Malvales (Malvaceae & Sterculiaceae), Ruttales (Rutaceae & Meliaceae), Rosales (Rosaceae & Leguminosae), Myrtales (Combretaceae & Myrtaceae), Rubiales (Rubiaceae), Verbenales (Verbenaceae), Asterales (Asteraceae), Unisexuales (Euphorbiaceae & Moraceae), Orchidales (Orchidaceae), Palmales (Arecaceae), Poales (Poaceae)	**16**
IV	Scope, objectives and methodologies of ethnobiology (Ethnobotany and Ethnozoology); Ethnobotany in relation to health care and drug discovery (Ethnomedicine & Ethnopharmacology).	**16**
Total		**64**

Credit Distribution		
Lecture/ Tutorial	**Practicum**	**EL**
60 hrs	**-**	**30 hrs**
		Field work, Assignment, Reflective thinking, case study, seminar, quiz

Textbooks:

1. Taxonomy of Angiosperms Nair R. Publisher: Aph Publishing Corporation. 2010
2. Plant Taxonomy: Advances and Relevance, 1st Edition: A. K. Pandey, et al. CBS Publisher; 2010

References:

1. Plant Taxonomy and Biosystematics, C. A. Stace, Edward Arnold, London, 1989.
2. Introduction to the Principle of Taxonomy, V.V. Sivarajan, edited by N. K. P. Robson, Oxford and IBH

Publishing Co. Pvt. Ltd. New Delhi, Calcutta.
3. Ethnobotany-Gary J. Martyn, Chapman& Hall, London,1995.

Semester-I
SEC: PLANT IDENTIFICATION AND HERBARIUM TECHNIQUES **Subject Code: BOT142S121** **L-T-P-C: 0-0-3-3,** **Credit Units: 03** **SCHEME OF EVALUATION: Practical (P)**

Course objective: To impart practical knowledge on various plant identification systems, their preservation and utilization.

Learning Outcomes: At the end of the course the student will be:

CO1	**Identify, describe,** and practice different methods of plant identification Systems	BT 2 & 3
CO2	**Categorize** different techniques used in preservation and utilize its knowledge in various field of application	BT 4

Detailed Syllabus:

Module	Course content	Lecture hours
I	**Plant identification:** Introduction, importance of plant identification. **Tools of identification:** Expert determination, Herbarium, taxonomic literature (Floras, Manuals, Monographs, Icons, Journals, Supporting literature), taxonomic keys, interactive keys/ visual keys, Computers in identification, molecular plantidentification.	**22**
II	**Plant nomenclature:** History of organized nomenclature, International Code of Nomenclature for Algae, Fungi and Plants (ICN)- ranks of taxa, valid and effective publications, principle of priority, changes of names, rejection of names, name of hybrids, and cultivated plants.	**22**
III	**Herbarium:** Introduction, definition, history, objective, types of herbaria, importance, major herbaria in the world and India. **Herbarium techniques:** Preparation for collection; field equipment, kinds of field work, Ethical guidelines for field works. Maintenance of Herbarium.	**22**
IV	**Herbarium Techniques for special types of plants:** Aquatic plants, cane, bamboo, succulents, rhizomatous plants, resinous plants, algae, Lichens, wild mushrooms, and bryophytes. **Digital/virtual herbarium**: Introduction and importance of digital herbaria. **Practical/ Project based on the syllabus.**	**24**
Total		**90**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	**PRACTICALS**	**EXPERIENTIAL LEARNING**

00	60	30 • FIELD VISITS • SAMPLE COLLECTION • HERBARIUM PREPARATION & SUBMISSION

Textbooks:

1. Simpson, M. G. 2006. Plant Systematics. Elsevier, Amsterdam
2. Rao and Jain 1976. A Handbook of Field and Herbarium methods
3. Singh, G. 2012. Plant Systematics- Theory and Practice. Oxford and IBH Publishing Co Pvt Ltd, NewDelhi
4. Sharma and Sharma 2007. Taxonomy. Pragati Prakashan, Meerut

Reference Books:

5. Anderson, N. O., and J. D. Walker. 2003. Effectiveness of Web-based versus live plant identification tests. Horttechnology 13:199-205.
6. Dirr, M. A. 1998. Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics,Culture, Propagation and Uses. Stipes Publishing, Champaign, IL
7. Kahtz, A. W. 2000. Can computer assisted instruction be used by students for woody plant identification. Horttechnology 10:381-384.

B. Sc. Course in Forestry: Semester-III

Paper I Major	**Forest Mensuration** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M301**

Course Objective:

This course aims to provide students with foundational knowledge and practical skills in forest mensuration, including measurement techniques, growth analysis, and advanced applications essential for managing forest resources effectively.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define key concepts in forest mensuration, including objectives, measurement scales, and units of measurement.	1
CO2	Explain the principles of tree form, area measurement, and the significance of precision, accuracy, and bias in forest measurements.	2
CO3	Identify different methods and instruments used for measuring diameter, girth, height, and volume of trees.	3
CO4	Analyze the impact of measurement errors on forest management decisions and evaluate the effectiveness of various mensuration techniques in forest growth analysis.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Forest Mensuration and Measurement Techniques** Forest Mensuration: Definition and objectives; scales of measurement; units of measurements; precision, bias, and accuracy.	16

	Measurement of Diameter and Girth: Place of measurement; rules governing breast height (BH) measurements; instruments used in measurements; diameter and girth classes. Measurement of Height: Definitions; methods of height measurement including ocular, non-instrumental, and instrumental methods; sources of error in height measurements, including leaning trees.	
II	**Tree Form, Area, and Volume Estimation** Tree Stem Form: Metzger's theory; form factor; types of form factor; form height quotient; form class. Estimation of Area: Cross-sectional area, basal area, and bole surface area. Volume Estimation: Methods of measuring the volume of standing trees, logs, and branch wood; formulae involved; definitions. Volume Tables: Preparation of volume tables using graphical and regression methods.	16
III	**Tree Growth and Increment Analysis** Determination of Growth of Trees: Concepts of increment, Current Annual Increment (CAI), Mean Annual Increment (MAI), and increment percent. Determination of Tree Age and Growth: Techniques for determining the age of trees and the classification of increments. Measurement of Tree Crops: Objectives; measurement of crop diameter, crop height, crop age, and crop volume.	16
IV	**Advanced Measurements and Practical Applications** Practical Applications: Calculation of volume of felled and standing trees. Preparation of volume tables. Application of different sampling methods. Preparation of yield and stand tables. Quantification of regeneration and stand establishment. Measurement of crown density and crown ratios. Crown profiling of trees and stands. Dendrochronological studies.	16
	Total	64

Textbooks:

1. Chaturvedi, A.N and L.S. Khanna (2011). Forest Mensuration and Biometry (5th edition). Khanna Bandhu. Dehra Dun.
2. Forest Mensuration: A Handbook for Practitioners. 2006. Forestry Commission Publications.
3. Husch, B., Beers, T.W. and Kershaw, J. J.A. (2002). Forest Mensuration (4th edition). John Wiley & Sons, Nature.

Reference Books:

1. Laar, V. A. and Akca, A. (2007). Forest Mensuration. Managing Forest Ecosystems. Vol.13. Springer.
2. Manikandan, K. and Prabhu, S. (2012). Indian Forestry. Jain Brothers. New Delhi.
3. West, P.W. (2009). Tree and Forest Measurement (2nd edition). Springer.

Paper II Major	**Silviculture & Nursery Technology** **L-T-P-C:3-1-0-4 Credit Unit:4 Evaluation Scheme: T**	**Course Code FOR142M302**

Course Objective: The course aims to provide students with a comprehensive understanding of forest nursery and regeneration techniques, including the principles of silviculture, nursery establishment, and advanced propagation methods.

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Define key terms related to forestry, silviculture, and nursery management	1
CO2	Explain the significance of site factors, tree growth patterns, and nursery establishment principles	2
CO3	Utilize the ability to establish a forest nursery, including site selection, nursery layout, seed sowing, and the application of growth management techniques such as fertilization and root culturing.	3
CO4	Examine various nursery techniques, and their advantages and disadvantages in different forest regeneration scenarios.	4

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	**Introduction to Forestry and Regeneration** Forests and Forestry: Definitions, significance, and overview of forestry. Silviculture: Objectives, scope, and its relation with other branches of forestry. Site Factors: Overview of climatic, edaphic, physiographic, biotic factors, and their interactions influencing forest sites. Regeneration Techniques: Overview of natural and artificial regeneration; objectives, advantages, disadvantages, and factors influencing the choice of regeneration techniques.	16
II	**Forest Nursery Establishment and Management** Introduction to Forest Nursery: Definition, scope, and significance of forest nurseries. Nursery Establishment: Site selection, planning, and layout of nursery areas. Types of Forest Nurseries: Different types and layouts, including nursery beds and preparation techniques. Seed Sowing and Growth Management: Methods of seed sowing, mulching, seedling growth, development, and maintenance (pricking, weeding, hoeing, organic matter supplements).	16
III	**Containerized Nursery and Planting Techniques** Containerized Nursery Techniques: Overview, type, and size of containers, merits and demerits of containerized nurseries. Root Trainer Techniques: Detailed study of root trainer techniques and preparation of ingredient mixtures. Planting Techniques: Techniques for planting containerized stock, bare-root seedlings, and handling methods for field planting. Propagation Methods: Overview of vegetative propagation, including budding, grafting, and layering; miniclonal and microcutting technologies.	16
IV	**Nursery Pest and Disease Management** Nursery Pests and Diseases: Identification of important nursery pests and diseases; control measures and management practices. Modern Nursery Equipment and Tools: Introduction and identification of modern equipment and tools used in nurseries.	16

	Advanced Nursery Operations: Preparation and planting of cuttings, pre-sowing seed treatments, and nursery practices for commercially important tree species. Nursery Visits and Practical Applications: Visits to forest nurseries, hands-on experience with nursery practices, assessment of nursery conditions, and exposure to best practices in nursery management.	
	Total	64

Textbooks:

1. Agrawal, R.L. (1986). Seed Technology. Oxford - IBH Publishing Co. New Delhi.
2. Bewely, J.D and Black, M. (1985). Seed- Physiology of development and germination.
3. Bose, T.K.; Mitra, S.K. and Sadhu, M.K. (1986). Propagation of tropical and sub-tropical Horticultural crops.NayaPrakash, Calcutta.
4. Chin, H.F. and Roberts, E.H. (1980). Recalcitrant Crop Seeds. Tropical Press Sdn. Bhd. Kuala Lumpur - 22-03, Malaysia.
5. Evans, J. and Turnbull, J.W. (2004). Plantation Forestry in the Tropics. 3rd edition. Oxford University Press.

Reference Books:

1. Hartmann, H.T. and Kester, D.E. (1968). Plant propagation – principles and practice prentice – Hall of India Private Limited, New Delhi.
2. ISTA (1993). International Rules for Seed Testing Rules. International Seed Testing Association, Zurich, Switzerland, 1993.
3. Khullar, P. et al. (1992). Forest Seed. ICFRE, New Forest, Dehra Dun.
4. Leadem, C.L. (1984). Quick Tests for Tree Seed Viability. B.C. Ministry of Forests and Lands, Canada.
5. Napier, I. and Robbins, M. (1989). Forest Seed and Nursery Practice in Nepal. Nepal-UK Forestry Research Project, Kathmandu.
6. 11. Prakash, R. (1990). Propagation Practices of Important Indian Trees. International Book Distributors, Dehra Dun.

Paper SEC	**Geology & Soil science** **L-T-P-C:2-1-1-3 Credit Unit:3 Evaluation Scheme: T+P**	**Course Code FOR142S31**

Course Objective:

This course aims to introduce students to the fundamental concepts of soil science, including geology, soil formation, physical and chemical properties of soils, and measurement techniques.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define key terms related to soil science, such as soil formation, physical and chemical properties, and types of soil water.	1
CO2	Explain the processes of soil formation, the significance of soil properties like texture, structure, and porosity, and their influence on soil function.	2
CO3	Identify different soil-forming minerals, weathering processes, and soil classification systems.	3
CO4	Apply measurement techniques to analyse soil properties, including texture, pH, and water content, using laboratory and field methods.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Geology and Soil Formation** Introduction to Geology: Definition, significance, and the composition of the earth's crust. Soil as a Natural Body: Major components by volume; pedology, and rock types; Soil Forming Minerals: Definition, classification of minerals including silicates, oxides, carbonates, sulphides, and phosphates; their occurrence and importance in soil formation. Weathering of Rocks and Minerals: Factors involved, weathering indices, and their impact on soil formation; Factors of Soil Formation: Parent material, climate, organisms, relief, and time; Soil Forming Processes: Eluviation, illuviation, and the formation of various soils. Soil Classification: Elementary knowledge of soil classification, soil orders, forest soil characteristics, and their distinguishing features compared to agricultural soils.	16
II	**Physical Properties of Soils** Soil Texture: Definition, methods of textural analysis, Stokes' law, and use of the textural triangle; Specific Gravity: Absolute specific gravity, apparent specific gravity/bulk density, factors affecting them, and their relationship; Pore Space: Definition, factors affecting capillary and non-capillary porosity; Soil Colour: Significance, colour variables (hue, value, chroma), and use of Munsell colour chart; factors influencing soil colour including parent material, soil moisture, and organic matter; Soil Structure: Definition, classification, factors influencing soil structure genesis, and soil consistency; Soil Plasticity and Atterberg's Constants: Understanding soil plasticity, liquid limit, plastic limit, and shrinkage limit. Soil Air and Temperature: Composition of soil air, factors influencing the amount of air space; sources and distribution of soil heat, factors affecting soil temperature, and measurement techniques.	16
III	**Chemical Properties of Soils** Soil Colloids: Organic colloids (humus), inorganic colloids (secondary silicate clay, hydrous oxides), and their roles in soil properties; Soil Organic Matter: Decomposition process and impact on soil fertility; Soil pH: Concept, soil acidity, nutrient availability, and soil buffering capacity; Problematic Soils: Overview of saline, sodic, and calcareous soils, their characteristics, and management strategies; Study of soil profiles of various parts of India. Importance of soil health on plant growth (humification, mineralization, decomposition etc).	16
IV	**Soil Water and Practical Applications** **S**oil Water: Forms of soil water, soil moisture content, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, and maximum water holding capacity. Energy Concepts and Soil Water Measurement: pF scale, gravimetric methods, electric methods, tensiometer, pressure plate, and pressure membrane apparatus; use of neutron probes. Soil Water Movement: Understanding saturated and unsaturated flow, infiltration, and percolation. Practical Applications:Mechanical analysis of soil; Determination of pH, organic carbon (C), cation exchange capacity (CEC); Analysis of available micro and macro nutrients. Formulating manurial schedules for different soil types.	16
	Total	64

Textbooks:

1. Biswas, T.D. and Mukherjee, S. K. (1987). Test Book of Soil Science, Tata McGraw Hill Publishing Co., New Delhi
2. Weil, R.R. and Brady, N.C. (2017). The Nature and Properties of Soils. 15th edition. Pearson Education.
3. Brady, N. C. (1990). Nature and Properties of Soils. 10th ed., Macmillan Publishing Co. Inc. New York

Reference Books:

1. Foth, H.D. and Turk, L. M. (1972). Fundamental of Soil Science. 5th edn. Wiley Eastern Pvt.Ltd., New Delhi
2. 5. Gupta, P.K. (2007). Soil, Plant, Water and Fertilizer Analysis. Published by AGROBIOS (India), Jodhpur
3. 6. Indian society of soil science (ISSS). (2002). Fundamentals of Soil Science. Published by Indian Society of Soil Science, IARI, New Delhi
4. 7. Indian Society of Soil Science (ISSS). (2015) Fundamental of Soil Science. 2nd Edition. Indian Society of Soil Science, IARI, New Delhi.

Paper Minor	**Forest Protection** **L-T-P-C: 3-1-0-4 Credit Unit:4 Evaluation Scheme: T**	**Course Code FOR142N301**

Course Objective:

This course aims to provide students with comprehensive knowledge and skills in forest protection, focusing on the impact of forest fires, human activities, weeds, diseases, and pests on forest ecosystems.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Explain the importance of forest protection and forest pathology, including the classification of tree diseases, their causes, symptoms, and impact on forest health.	1&2
CO2	Identify and assess injuries caused by human activities such as lopping, cutting for fuel wood, and different forms of forest encroachment.	3
CO3	Examine the factors leading to pest outbreaks and methods of pest control, including silvicultural, legal, biological, and chemical approaches.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Human Activities in Forests** Damage by Humans: Cutting trees and using forest land harms forests. Illegal Activities: Encroachment and illegal tree cutting are controlled by laws. Live Fencing: Using plants like Caesalpiniabonduc as fences.	16
II	**Forest Fires – Control** Introduction: Protecting forests from fires is important. Causes: Fires are caused by nature or human activities. Prevention and Control: Prevent fires and use equipment to fight them.	16
III	**Weed and Disease Management** Forest Weeds: Weeds and climbers damage forests and need to be managed. Tree Diseases: Diseases harm trees; they need to be identified and controlled.	16

IV	**Forest Entomology** Forest Pests: Insects damage trees. Pest Control: Use methods like biological control and chemicals to manage pests.	16
	Total	64

Textbooks:

1. Tainter, F.H. and Baker, F.A. (1996). Principles of Forest Pathology. John Wiley & Sons, New York, USA.
2. Paul, D. M. (1990). Tree Disease Concepts. Prentice-hall, Inc. New Jersey.
3. Wayne, S. and Howard, H.L. (2005). Diseases of Trees and Shrubs, 2nd edition, Comstock Publishing Associates.
4. Horst, R. Kenneth (2013). Field Manual of Diseases on Trees and Shrubs, Springer Netherlands.

Reference Books:

1. Luna, R.K. (2007). Principles and Practices of Forest Fire Control. International Book Distributors, Dehradun.
2. Negi, S.S. (1999). Handbook of Forest Protection. International Book Distributors.
3. Pathak, V.N., Khatri, N.K. and Pathak, M. (2000). Fundamentals of Plant Pathology. Eds. Agribios (India), Jodpur.
4. Singh, R.S. (2002). Introduction Principles of Plant Pathology. Oxford & IBH, New Delhi.

B. Sc. Course in Forestry: Semester-IV

Paper Major	**Principles of Agroforestry** **L-T-P-C:2-0-1-3 Credit Unit: 3 Evaluation Scheme: T+P**	**Course Code FOR142M401**

Course Objective: To provide students with a comprehensive understanding of sustainable agriculture and agroforestry principles, enabling them to analyze and apply various agroforestry practices to enhance biodiversity, improve land use management, and promote sustainable resource utilization.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define key concepts related to sustainable agriculture and agroforestry, including agrobiodiversity, nutrient cycling, and tree-crop interactions.	1
CO2	Explain the significance of agroforestry in addressing the demands for fuelwood, fodder, and timber, as well as its ecological and economic benefits.	2
CO3	Demonstrate the ability to assess tree-crop interactions and apply management practices to enhance positive interactions while minimizing negative effects in agroforestry systems.	3
CO4	Analyse the interactions between trees and crops in agroforestry systems, assessing their effects on nutrient management, productivity, and ecological sustainability.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Sustainable Agriculture**	16

	Overview of the agricultural scenario, its structure, and constraints Concept of sustainable agriculture and land use management Paradigm shift in agricultural development and impacts of the Green Revolution; Agrobiodiversity: significance, threats, and conservation strategies	
II	**Fundamentals of Agroforestry** Definition and scope of agroforestry; Rising demands for fuelwood, fodder, and timber; Social, ecological, and economic reasons for agroforestry; Historical development of agroforestry Classification of agroforestry systems; Components of agroforestry and their provisioning and regulatory services Carbon credit, Green credits, socio-economic valuation and economics parts, sustainable agroforestry	16
III	**Interactions and Nutrient Management in Agroforestry** Nutrient cycling and soil improvement; Increased production and productivity in agroforestry systems; Microclimate amelioration and carbon sequestration; Tree-crop interactions:Definition and types of interactions (positive and negative) Concepts of complementarity, compatibility, mutualism, and commensalism; Negative interactions: allelopathy and competition Management of interactions: aboveground and belowground interactions, manipulation of density, space, crown, and roots Nursery management and Quality Planting material	16
IV	**Tree Management and Crop Planning in Agroforestry** Structure and growth of trees, crown and root architecture Agroforestry practices to minimize negative interactions: coppicing, thinning, pollarding, and pruning; Crop planning and management:Selection of suitable crops; Management of nutrients, water, and weeds; National Agroforestry Policy 2014 and relevant national and international organizations in agroforestry **Practicals:** Visit agroforestry sites with different crop combinations; Harvesting and marketing of agroforestry produce; Visits to traditional multistoried homestead gardens, commercial agroforestry plantations, and food forests	16
	Total	64

Textbooks:

1. Tejwani, K. G. (2002). *Agro forestry in India*. Concept Publishing Company.
2. Nair, P. R., Kumar, B. M., & Nair, V. D. (2021). An introduction to agroforestry: four decades of scientific developments (pp. 3-20). Cham: Springer.

Reference Books:

1. Nair, P.K.R., Kumar, B.M. and Vimala D. N. (2009). Agroforestry as a strategy for carbon sequestration. J. Plant Nutr. Soil Sci. 172: 10–23.
2. Atangana, A., Khasa, D., Chang, S., Degrande, A., Atangana, A., Khasa, D., ... &Degrande, A. (2014). Definitions and classification of agroforestry systems. Tropical agroforestry, 35-47.

Paper II Major	**Forest Management** **L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code FOR142M402**

Course Objective: To equip students with a comprehensive understanding of the principles and practices of forest management, including the concepts of sustainable forestry, community involvement, and operational techniques, enabling them to effectively contribute to forest conservation and management in diverse ecological and social contexts.

Course Outcome:

On successful completion of the course, the students will able to:	**Bloom's cognitive level**

CO1	Define key concepts related to forest management, including sustained yield, sustainable forest management, and community forestry.	1
CO2	Explain the principles of sustainable forest management and the significance of community involvement in forestry practices.	2
CO3	Apply the principles of forest management to analyse case studies, demonstrating how various management techniques can be implemented in real-world scenarios.	3
CO4	Evaluate different forest management strategies and their effectiveness in achieving sustainable yields and community benefits, identifying potential challenges and areas for improvement.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Forest Management** Definitions, Scope, Objectives, and Principles of Forest Management: Understanding the fundamental concepts and organizational structure of state forests. Sustained Yield: Definition, principles, and limitations of sustained yield forestry. Sustainable Forest Management: Criteria and indicators of sustainability; increasing and progressive yields. Rotation: Definitions, various types of rotations, determining rotation length, and factors influencing the choice of rotation. Tools for sustainable forest management -Forest certification, Trees outside Forest (ToF) standard rules, International Guidelines for Sustainable Forest Management	16
II	**Concepts of Normal Forest and Working Plans** Normal Forest: Definitions, basic factors of normality, and factors governing the yield and growth of forest stands. Working Plan: Preparation, objectives, and uses of working plans in forestry; the role of forest maps. Modern Tools in Forest Management: Introduction to modern tools and techniques used in managing forests. Joint Forest Management (JFM): Concept, principles, and its role in participatory forest management.	16
III	**Community Forestry and Social Forestry** Forestry as a Common Property Resource: Definition, scope, and necessity of community forestry; integration of forestry with agriculture, animal husbandry, and horticulture. Importance of community involvement in forest conservation; the role of NGOs, civil societies, and citizen groups in community forest management. Social Forestry: Definition, objectives, and significance as outlined in the NCA report of 1976; the role of social forestry in rural development, including fodder, fuelwood, and timber production.	16
IV	**Integrated Rural Development and Operational Techniques** Community Forest Development: Social, economic, and environmental aspects; community mobilization approach to forest conservation and management. Integrated Rural Development Approach: Role of forestry in rural livelihoods, Role of Government Departments/Ministries in rural livelihood, alternate employment generation, and the importance of proper marketing facilities. Operational Techniques in Forest Management: Case analysis using forest inventories, operational research methods, and simulation modeling for forest operations and processing facilities.	16

	Total	64

Textbooks:

1. BalaKathiresan, S. (1986). Essentials of Forest Management, Nataraj Publishers, Dehradun.
2. Bhattacharya, P., Kandya A.K. and Kumar, K. (2008). Joint Forest Management in India, Aavishkar Publisher, Jaipur.
3. Desai, V. (1991). Forest Management in India– Issues and Problems. Himalaya Publisher House, Bombay.

Reference Books:

1. Edmunds, D. and Wollenberg, E. (2003). Essentials of Forest Management. Natraj Publishers, Dehradun.
2. Jerome, L.C. (1983). Timber Management: A Quantitative Approach. John Wiley and Sons.
3. National Working Plan Code. (2014). MoEF, New Delhi.
4. Prakash, R. (1986). Forest Management. IBD, Dehradun, India.
5. Recknagel, A.B. and Bentley. J. (1988). Forest Management. IBD, Dehradun.
6. Trivedi, P.R. and Sudarshan, K.N. (1996). Forest Management. Discovery publications, New Delhi.

Paper III Major	**Forest Resources Utilization** **L-T-P-C:2-0-1-3 Credit Unit:3 Evaluation Scheme: T+P**	**Course Code FOR142M403**

Course Objective: To provide students with a comprehensive understanding of the significance of wood and wood-based industries in the Indian economy, including the methods of wood modification, the utilization of lesser-known forest species, and the cultivation and extraction practices of medicinal and aromatic plants.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define and describe the various uses of wood and the types of wood-based industries in India, including their significance in the economy.	1
CO2	Explain the processes involved in wood modification and the characteristics of different forest-based industries, such as pulp and paper, furniture, and composite wood.	2
CO3	Demonstrate the methods of cultivation and extraction of essential oils from selected medicinal and aromatic plants, including the identification and classification of these species.	3
CO4	Analyse the impact of globalization on the growth of wood-based industries in India and evaluate the economic significance of medicinal and aromatic plants, considering their potential for conservation and sustainable use.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Wood and Forest-Based Industries** Overview of wood uses and the growth of the wood-based industry in India; Impact of globalization on the wood industry; Importance of forest-based industries in the Indian economy; Wood as a source of energy and chemicals; Role of wood as raw material in industries like pulp, paper, rayon, composite woods, and improved woods.	16
II	**Types of Forest-Based Industries** Description of various forest-based industries:Paper and pulp industry; Furniture manufacturing; Bamboo processing.	16

	Production of sports goods, pencil-making, matchbox, and splint-making; Utilization of lesser-known forest species for commercial purposes; Structural uses of timber, including bridges and superstructures; Decorative applications of wood.	
III	**Wood Modification and Composite Wood** Introduction to wood modification: need and scope. Chemical modification of wood (acetylation, reaction with isocyanates, etc.); Primary conversion processes: sawing and veneering; Manufacturing processes, properties, and uses of:Composite wood, plywood, laminated wood, core board, sandwich board, fibre board, and particle board; Adhesives used in the manufacture of composite wood; Overview of improved wood, compressed wood, and impregnated wood.	16
IV	**Importance of Animal/wildlife in forest resource utilization** **Practical Component:** Exposure to wood seasoning and preservation techniques; Determination of wood physical and mechanical properties; Practical sessions on wood histology. Field execution and identification of relevant plant species. Nursery techniques for 20 species (3 tropical, 3 sub-tropical). Visits to timber depots, sawmills, NeDFI, and other related organizations.	16
	Total	64

Textbooks:

1. Atul, C.K. and Kapur, B.K. (1982). Cultivation and utilization of medicinal plants. RRL, CSIR, Jammu-Tawi.
2. Chopra, R.N., Nayar, S.L. and Chopra, I.C. (1956). Glossary of Indian medicinal plants. CSIR, New Delhi.
3. Cunningham, A. (2014). Applied Ethnobotany: "People, Wild Plant Use and Conservation". Taylor & Francis

Reference Books:

1. EIRI Board. (2007). Handbook of Medicinal and Aromatic Plants: Cultivation, Utilisation and Extraction
2. Jain, S.K. (2010). Manual of Ethnobotany (2nd Ed). Scientific Publishers, India.

Paper IKS	**Indigenous Practices in Forestry and Sustainable Resource Management** **L-T-P-C:2-0-1-3 Credit Unit: 3 Evaluation Scheme: T+P**	**Course Code FOR142M404**

Course Objective: The objective of this course is to provide students with an understanding of Indian Knowledge Systems (IKS) in forestry and forest products, focusing on traditional ecological practices, bio-resource use, and indigenous healthcare systems, and their role in sustainable forest management and conservation.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Recall traditional practices of forest conservation, sacred groves, and spiritual practices.	1
CO2	Explain the role of myths, rituals, and taboos in sustainable forest management and resource conservation.	2
CO3	Apply indigenous methods of dye extraction and wood processing in practical situations.	3
CO4	Compare and contrast traditional ecological knowledge with modern forestry practices to evaluate their sustainability..	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Indigenous Belief Systems and Forest Conservation** Role of beliefs and taboos in forest conservation; Conservation linked to sacred groves and water bodies; Folk Narratives and Ecological Knowledge: Stories, songs, dances, and proverbs reflecting forest wisdom; Traditional Forest Narratives: Plays, acts, and their role in cultural transmission of ecological knowledge. Symbolism of animals in indigenous belief systems and rituals Traditional Conflict Mitigation Strategies-Use of live fences (e.g., *Caesalpiniabonduc*), buffer zones, and sustainable hunting practices.	16
II	**Indigenous Practices in Agriculture and Resource Management** Sustainable practices in agriculture and livestock management; Spiritual and cultural methods for conserving forests and water; Techniques for maintaining soil health and resource management.	16
III	**Bio-resource Utilization and Handicrafts** Traditional methods of resource utilization and food storage; Indigenous techniques in wood carving, fiber extraction, and costume creation; Extraction and use of plant fibers in everyday life.	16
IV	**Traditional Healthcare and Dyeing Techniques** Vaidya, Tantra-Mantra, and Amchi medicine; Spiritual Healing Practices: Connection between spiritual beliefs and forest resources; Chemistry of natural dyes and traditional dyeing methods; Traditional knowledge of dye-making and wood carving techniques.	16
	Total	64

Textbooks:

3. Huxley, P. (1999). Tropical Agroforestry. Wiley.
4. Kumar, B.M. and Nair, P.K.R (eds). (2011). Carbon Sequestration Potential of Agroforestry Systems: Opportunities and challenges. Advances in Agroforestry 8. Springer Science, The Netherlands.

Reference Books:

3. Nair, P.K.R., Kumar, B.M. and Vimala D. N. (2009). Agroforestry as a strategy for carbon sequestration. J. Plant Nutr. Soil Sci. 172: 10–23.
4. Pathak, P.S. and Newaj, R. (eds.) (2003). Agroforestry: Potentials and Opportunities. Agrobios, Jodhpur.

Paper Minor	**WILDLIFE BIOLOGY** **L-T-P-C: 3-1-0-4 Credit Unit:4 Evaluation Scheme: T**	**Course Code FOR142N401**

Course Objective:

This course aims to provide students with a comprehensive understanding of wildlife conservation, management, and ecology. It covers the causes of wildlife depletion, conservation needs, species identification, wildlife management techniques, and census methods.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define key concepts of wildlife, including the causes of wildlife depletion and the need for conservation.	1
CO2	Explain the impact of biotic factors, light, and temperature on wildlife and the principles underlying wildlife ecology and management.	2
CO3	Apply vegetative analysis methods and use GIS and remote sensing tools for wildlife habitat surveys and management.	3

CO4	Analyze the factors contributing to wildlife depletion and assess the effectiveness of current conservation strategies	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to wildlife** Wildlife: Definition and scope; Causes of wildlife depletion, need for wildlife conservation. Values of Wildlife: Ethical, cultural, scientific, economical, aesthetic and negative values. Rare, endangered, threatened and endemic species of fishes, amphibians, reptiles, birds and mammals in India.	16
II	**Wildlife ecology** Biotic factors, biological basis of wildlife, productivity. Effect of light and temperature on animals; Zoogeographical regions (Animal Distribution). Basic requirements of wildlife: food, water, shelter, space, limiting factors.	16
III	**Wildlife - conservation** In-situ and ex-situ conservation: definition, formation, management andadministration of Wildlife Sanctuaries, National Parks, Tiger Reserves and Biosphere Reserves. Wildlife Projects: Tiger, Elephant, Lion and HanSgul; Zoos Captive breeding: aims, principles, methods; role of Government and Non-Governmental Organizations in conservation.	16
IV	**Wildlife management** Vegetative analyses – Point Centered Quadrat, Quadrat, Strip transect. GIS and Remote sensing in wildlife habitat survey; Habitat manipulation: food, water, shade improvement; impact and removal of invasive alien species.	16
	Total	64

Textbooks:

1. Silvy, N. J. (Ed.). (2020). The Wildlife Techniques Manual: Volume 1: Research. Volume 2: Management. JHU Press.
2. Krausman, P. R., & Cain, J. W. (Eds.). (2022). *Wildlife management and conservation: contemporary principles and practices*. JHU Press.

Reference Books:

1. Mills, L. S. 2013. Conservation of Wildlife Populations Demography, Genetics and Management. Wiley-Blackwell, New Jersey, USA
2. Sawarkar, B. 2005. Wildlife Management. Wildlife Institute of India. Dehradun.
3. Wildlife Institute of India (2004) Compendium on the notes on the course Captive management of Endangered Species. Wildlife Institute of India. Dehradun.

Paper Minor	**FOREST ECOLOGY AND BIODIVERSITY CONSERVATION** **L-T-P-C: 3-1-0-4 Credit Unit:4 Evaluation Scheme: T**	**Course Code FOR142N402**

Course Objective:

To introduce students to the fundamental principles of forest ecology and biodiversity conservation, emphasizing the structure, function, and sustainable management of forest ecosystems, along with the strategies for conserving biodiversity.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Recall the basic concepts of forest ecosystems, including types of forests and their ecological significance.	1
CO2	Explain the importance of biodiversity within forest ecosystems and identify key threats to forest biodiversity.	2
CO3	Apply conservation strategies, such as sustainable forest management and biodiversity protection, to case studies or real-world scenarios.	3
CO4	Analyse the role of forests in climate change mitigation and assess the impact of afforestation and reforestation efforts.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Forest Ecology** Overview of forest ecosystems and their role in the environment. Types of Forests: Tropical, temperate, boreal, and their global distribution. Forest Structure and Function: Canopy layers, nutrient cycling, and energy flow in forests.	16
II	**Forest Biodiversity** Biodiversity Concepts: Species, genetic, and ecosystem diversity in forests. Importance of Forest Biodiversity: Ecological, economic, and social benefits. Threats to Biodiversity: Habitat loss, deforestation, invasive species, and climate change.	16
III	**Conservation of Forest Ecosystems** Conservation Strategies: In-situ (protected areas, national parks) and ex-situ (seed banks, botanical gardens). Sustainable Forest Management: Community forestry, agroforestry, and responsible logging practices. Conservation Policies and Legislation: National and international frameworks (e.g., CBD, REDD+).	16
IV	**Role of Forests in Climate Change Mitigation** Forests as Carbon Sinks: Role in reducing carbon dioxide in the atmosphere. Afforestation and Reforestation: Methods and benefits. Forest Restoration Initiatives: Examples of global and local efforts to restore degraded forest ecosystems.	16
	Total	64

Textbooks:

1. Singh, M. P., Singh, J. K., & Mohanka, R. (2007). Forest environment and biodiversity. Daya Books.
2. Montagnini, F., & Jordan, C. F. (2005). Tropical forest ecology: the basis for conservation and management (Vol. 25275211). Berlin: Springer.

Reference Books:

1. Newton, A. (2007). Forest ecology and conservation: a handbook of techniques. Oxford University Press, USA.

2. Shukla, G., & Chakravarty, S. (2017). Forest Ecology and Conservation. InTech.

B. Sc. Course in Forestry: Semester-IV

Paper I Major	Forest Protection **L-T-P-C: 2-0-1-3 Credit Unit: 3 Evaluation Scheme: T+P**	**Course Code FOR142M401**

Course Objective: To provide students with a comprehensive understanding of forest protection, focusing on the causes, management, and control of forest fires, tree diseases, and pest infestations.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define key concepts of forest protection, including forest fires, pathology, and pest management.	1
CO2	Identify common forest diseases, pests, and factors affecting forest health.	2
CO3	Demonstrate the use of various methods and equipment for fire prevention, disease management, and pest control in forest settings.	3
CO4	Analyse the interactions between biotic and abiotic factors in forest ecosystems that contribute to disease and pest outbreaks.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Forest Protection and Fire Management** Introduction to Forest Protection: Importance of protection in Indian Forestry; classification of injurious agencies affecting forests. Forest Fires: Injury to forests due to fires, causes, and characteristics of forest fires; types of fires, fire prevention activities, and fire suppression techniques. Fire Fighting: Firefighting equipment; fire control policy and objectives; firefighting practices in other countries.	16
II	**Forest Pathology and Disease Management** Introduction to Forest Pathology: Importance, objectives, and principles; classification of tree diseases; causes and symptoms of forest diseases. Disease Management: Etiology, disease cycle, mode of spread, and epidemiology; management practices including chemical, biological, cultural, and silvicultural techniques; abiotic diseases and diseases due to physiological causes. Weed and Nursery Disease Management: Management of forest weeds, woody climbers, parasites, and epiphytes; common nursery diseases and their management strategies.	16
III	**Specific Tree Diseases and Control Measures** Losses Due to Tree Diseases: Symptoms, mode of spread, etiology, and epidemiology. Types of Diseases and Control Measures: Root Diseases: Wilt, root, and butt rot. Stem Diseases: Heart rots, stem blisters, rusts, stem wilt, cankers, pink disease, gummosis, water blister. Foliar Diseases: Rust, powdery mildew, leaf spot, leaf and twig blight, abnormal leaf fall, needle blight.	16

	Control Measures: Chemical, biological, cultural, and silvicultural practices.	
IV	**Forest Entomology and Pest Management** Forest Injuries Due to Human and Animal Activities: Lopping, cutting for fuelwood, types of encroachment, control of encroachment, illegal felling of trees, and control legislation. Forest Entomology: Overview of forest entomology in India; classification of forest pests, types of damage, and symptoms. Pest Management: Methods and principles of pest control, including cultural, mechanical, physical, silvicultural, legal, biological, and chemical methods; integrated pest management (IPM). Insect Pests and Damage Management: Pests affecting forest seeds, nursery, standing trees, plantations, felled trees, and stored timbers; factors for outbreak and management strategies. Practical Applications: Collection and identification of insect pests and non-insect pests. Inspection and collection of insect-damaged plant specimens. Collection, preservation, and identification of tree diseases, forest nursery, and plantation diseases. Field visits to observe and document pest and disease infestations on common trees.	16
	Total	64

Textbooks:

5. Tainter, F.H. and Baker, F.A. (1996). Principles of Forest Pathology. John Wiley & Sons, New York, USA.
6. Paul, D. M. (1990). Tree Disease Concepts. Prentice-hall, Inc. New Jersey.
7. Wayne, S. and Howard, H.L. (2005). Diseases of Trees and Shrubs, 2nd edition, Comstock Publishing Associates.
8. Horst, R. Kenneth (2013). Field Manual of Diseases on Trees and Shrubs, Springer Netherlands.

Reference Books:

5. Luna, R.K. (2007). Principles and Practices of Forest Fire Control. International Book Distributors, Dehradun.
6. Negi, S.S. (1999). Handbook of Forest Protection. International Book Distributors.
7. Pathak, V.N., Khatri, N.K. and Pathak, M. (2000). Fundamentals of Plant Pathology. Eds. Agribios (India), Jodpur.
8. Singh, R.S. (2002). Introduction Principles of Plant Pathology. Oxford & IBH, New Delhi.

Paper II Major	Forest Management **L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code FOR142M402**

Course Objective: To equip students with a comprehensive understanding of the principles and practices of forest management, including the concepts of sustainable forestry, community involvement, and operational techniques, enabling them to effectively contribute to forest conservation and management in diverse ecological and social contexts.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define key concepts related to forest management, including sustained yield, sustainable forest management, and community forestry.	1
CO2	Explain the principles of sustainable forest management and the significance of community involvement in forestry practices.	2
CO3	Apply the principles of forest management to analyse case studies, demonstrating how various management techniques can be implemented in real-world scenarios.	3
CO4	Evaluate different forest management strategies and their effectiveness in achieving sustainable yields and community benefits, identifying potential challenges and areas for improvement.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Forest Management** Definitions, Scope, Objectives, and Principles of Forest Management: Understanding the fundamental concepts and organizational structure of state forests. Sustained Yield: Definition, principles, and limitations of sustained yield forestry. Sustainable Forest Management: Criteria and indicators of sustainability; increasing and progressive yields. Rotation: Definitions, various types of rotations, determining rotation length, and factors influencing the choice of rotation.	16
II	**Concepts of Normal Forest and Working Plans** Normal Forest: Definitions, basic factors of normality, and factors governing the yield and growth of forest stands. Working Plan: Preparation, objectives, and uses of working plans in forestry; the role of forest maps. Modern Tools in Forest Management: Introduction to modern tools and techniques used in managing forests. Joint Forest Management (JFM): Concept, principles, and its role in participatory forest management.	16
III	**Community Forestry and Social Forestry** Forestry as a Common Property Resource: Definition, scope, and necessity of community forestry; integration of forestry with agriculture, animal husbandry, and horticulture. National Forest Policy 1988: Importance of community involvement in forest conservation; the role of NGOs, civil societies, and citizen groups in community forest management.	16

	Social Forestry: Definition, objectives, and significance as outlined in the NCA report of 1976; the role of social forestry in rural development, including fodder, fuelwood, and timber production.	
IV	**Integrated Rural Development and Operational Techniques** Community Forest Development: Social, economic, and environmental aspects; community involvement in forest conservation through various groups and organizations. Integrated Rural Development Approach: Role of forestry in rural livelihoods, employment generation, and the importance of proper marketing facilities. Operational Techniques in Forest Management: Case analysis using forest inventories, operational research methods, and simulation modeling for forest operations and processing facilities.	16
	Total	64

Textbooks:

1. BalaKathiresan, S. (1986). Essentials of Forest Management, Nataraj Publishers, Dehradun.
2. Bhattacharya, P., Kandya A.K. and Kumar, K. (2008). Joint Forest Management in India, Aavishkar Publisher, Jaipur.
3. Desai, V. (1991). Forest Management in India– Issues and Problems. Himalaya Publisher House, Bombay.

Reference Books:

7. Edmunds, D. and Wollenberg, E. (2003). Essentials of Forest Management. Natraj Publishers, Dehradun.
8. Jerome, L.C. (1983). Timber Management: A Quantitative Approach. John Wiley and Sons.
9. National Working Plan Code. (2014). MoEF, New Delhi.
10. Prakash, R. (1986). Forest Management. IBD, Dehradun, India.
11. Recknagel, A.B. and Bentley. J. (1988). Forest Management. IBD, Dehradun.
12. Trivedi, P.R. and Sudarshan, K.N. (1996). Forest Management. Discovery publications, New Delhi.

Paper III Major	Forest Resources Utilization L-T-P-C:2-0-1-3 Credit Unit:3 Evaluation Scheme: T+P	Course Code FOR142M403

Course Objective: To provide students with a comprehensive understanding of the significance of wood and wood-based industries in the Indian economy, including the methods of wood modification, the utilization of lesser-known forest species, and the cultivation and extraction practices of medicinal and aromatic plants.

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Define and describe the various uses of wood and the types of wood-based industries in India, including their significance in the economy.	1
CO2	Explain the processes involved in wood modification and the characteristics of different forest-based industries, such as pulp and paper, furniture, and composite wood.	2
CO3	Demonstrate the methods of cultivation and extraction of essential oils from selected medicinal and aromatic plants, including the identification and classification of these species.	3
CO4	Analyse the impact of globalization on the growth of wood-based industries in India and evaluate the economic significance of medicinal and aromatic plants, considering their potential for conservation and sustainable use.	4

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	**Introduction to Wood and Forest-Based Industries** Overview of wood uses and the growth of the wood-based industry in India. Impact of globalization on the wood industry. Importance of forest-based industries in the Indian economy. Wood as a source of energy and chemicals. Role of wood as raw material in industries like pulp, paper, rayon, composite woods, and improved woods.	16
II	**Types of Forest-Based Industries** Description of various forest-based industries: Paper and pulp industry. Furniture manufacturing. Bamboo processing. Production of sports goods, pencil-making, matchbox, and splint-making. Utilization of lesser-known forest species for commercial purposes. Structural uses of timber, including bridges and superstructures. Decorative applications of wood.	16
III	**Wood Modification and Composite Wood**	16

	Introduction to wood modification: need and scope. Chemical modification of wood (acetylation, reaction with isocyanates, etc.). Primary conversion processes: sawing and veneering. Manufacturing processes, properties, and uses of: Composite wood, plywood, laminated wood, core board, sandwich board, fibre board, and particle board. Adhesives used in the manufacture of composite wood. Overview of improved wood, compressed wood, and impregnated wood. **Medicinal and Aromatic Plants** Role of medicinal and aromatic plants in the Indian economy. Important essential oil-yielding plants in India: Methods of extraction and evaluation of essential oils. Detailed study of Lemon grass, Citronella, Palmarosa, Vetiver, Japanese mint, Eucalyptus, Jasmine, Patchouli, and Geranium: botany, climate, soil requirements, planting, cultural practices, harvesting, and oil extraction.	
IV	**Overview of medicinal plants in India, focusing on NE India:** History, origin, distribution, botany, cultivation, extraction of active principles, and uses of various medicinal plants (e.g., Atropa, Cinchona, Rauvolfia, Opium, Sandal, Acorus, Cannabis, Digitalis, Strychnos nux-vomica, Aconitum, Neem, Dioscorea, Costus, Solanum). Conservation strategies for wild medicinal plants. **Practical Component** Activities: Exposure to wood seasoning and preservation techniques. Determination of wood physical and mechanical properties. Practical sessions on wood histology. Field execution and identification of relevant plant species. Nursery techniques for 20 species (3 tropical, 3 sub-tropical). Visits to timber depots, sawmills, NeDFI, and other related organizations.	16
	Total	64

Textbooks:

1. Atul, C.K. and Kapur, B.K. (1982). Cultivation and utilization of medicinal plants. RRL, CSIR, Jammu-Tawi.
2. Chopra, R.N., Nayar, S.L. and Chopra, I.C. (1956). Glossary of Indian medicinal plants. CSIR, New Delhi.
3. Cunningham, A. (2014). Applied Ethnobotany: "People, Wild Plant Use and Conservation". Taylor & Francis

Reference Books:

3. EIRI Board. (2007). Handbook of Medicinal and Aromatic Plants: Cultivation, Utilisation and Extraction
4. Jain, S.K. (2010). Manual of Ethnobotany (2nd Ed). Scientific Publishers, India.

Paper IV Major	Principles of Agroforestry L-T-P-C:2-0-1-3 Credit Unit: 3 Evaluation Scheme: T+P	Course Code FOR142M403

Course Objective: To provide students with a comprehensive understanding of sustainable agriculture and agroforestry principles, enabling them to analyze and apply various agroforestry practices to enhance biodiversity, improve land use management, and promote sustainable resource utilization.

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Define key concepts related to sustainable agriculture and agroforestry, including agrobiodiversity, nutrient cycling, and tree-crop interactions.	1
CO2	Explain the significance of agroforestry in addressing the demands for fuelwood, fodder, and timber, as well as its ecological and economic benefits.	2
CO3	Demonstrate the ability to assess tree-crop interactions and apply management practices to enhance positive interactions while minimizing negative effects in agroforestry systems.	3
CO4	Analyse the interactions between trees and crops in agroforestry systems, assessing their effects on nutrient management, productivity, and ecological sustainability.	4

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	**Introduction to Sustainable Agriculture** Overview of the agricultural scenario, its structure, and constraints Concept of sustainable agriculture and land use management Paradigm shift in agricultural development and impacts of the Green Revolution Agrobiodiversity: significance, threats, and conservation strategies	16
II	**Fundamentals of Agroforestry** Definition and scope of agroforestry Rising demands for fuelwood, fodder, and timber Social, ecological, and economic reasons for agroforestry Historical development of agroforestry Components of agroforestry and their provisioning and regulatory services	16
III	**Interactions and Nutrient Management in Agroforestry** Nutrient cycling and soil improvement Increased production and productivity in agroforestry systems Microclimate amelioration and carbon sequestration Tree-crop interactions: Definition and types of interactions (positive and negative)	16

	Concepts of complementarity, compatibility, mutualism, and commensalism Negative interactions: allelopathy and competition Management of interactions: aboveground and belowground interactions, manipulation of density, space, crown, and roots	
IV	**Tree Management and Crop Planning in Agroforestry** Structure and growth of trees, crown and root architecture Agroforestry practices to minimize negative interactions: coppicing, thinning, pollarding, and pruning Crop planning and management: Selection of suitable crops Management of nutrients, water, and weeds Classification of agroforestry systems National Agroforestry Policy 2014 and relevant national and international organizations in agroforestry **Practicals** Visit agroforestry sites with different crop combinations Harvesting and marketing of agroforestry produce Visits to traditional multistoried homestead gardens, commercial agroforestry plantations, and food forests	16
	Total	64

Textbooks:

5. Huxley, P. (1999). Tropical Agroforestry. Wiley.
6. Kumar, B.M. and Nair, P.K.R (eds). (2011). Carbon Sequestration Potential of Agroforestry Systems: Opportunities and challenges. Advances in Agroforestry 8. Springer Science, The Netherlands.

Reference Books:

5. Nair, P.K.R., Kumar, B.M. and Vimala D. N. (2009). Agroforestry as a strategy for carbon sequestration. J. Plant Nutr. Soil Sci. 172: 10–23.
6. Pathak, P.S. and Newaj, R. (eds.) (2003). Agroforestry: Potentials and Opportunities. Agrobios, Jodhpur.

B. Sc. Course in Forestry: Semester-V

Paper I Major	**Forest Policy and Legislation** **L-T-P-C: 3-1-0-4 Credit Unit: 4 Evaluation Scheme: T**	**Course Code FOR142M501**

Course Objective:
This course aims to provide students with the knowledge on various policies and acts related to forests
Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Recall the fundamental concepts of forest policies, legal frameworks, and governance structures related to forestry in India.	1
CO2	Explain the evolution of National Forest Policies (1894, 1952, and 1988) and their impact on forest conservation, management, and community rights.	2
CO3	Apply knowledge of forestry laws to real-world forestry governance and conservation scenarios.	3

CO4	Analyze the constraints in implementing forest policies and laws, assess their effectiveness, and suggest improvements for sustainable forest management.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Forest Policy and Governance** Necessity of a Forest Policy – Importance, objectives, and principles. General Basis of Formulation – Ecological, economic, social, and legal considerations. Comparative Study of National Forest Policies – National Forest Policy of 1894, 1952, and 1988 Basis of their formulation and their aftereffects Constraints in the Implementation of Forest Policy in India Need-Based Law for Policy Implementation	16
II	**National and State Forestry Action Programs** National Forestry Action Program (NFAP) – Objectives, formulation, and implementation constraints. State Forestry Action Programs (SFAPs) – Variations and effectiveness. Forest Law – Legal Definition and Scope Indian Forest Act, 1927 – Detailed study of provisions and amendments. Forest (Conservation) Act, 1980 – Key provisions, amendments, and impacts.	16
III	**Legal Framework Governing Forests and Wildlife** The Biological Diversity Act, 2002 – Objectives, conservation, and access to biological resources. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 – Rights, governance, and conflicts. Environmental Protection Act, 1986 – Legal framework and role in forest conservation. National Green Tribunal (NGT) – Powers, jurisdiction, and impact on forest governance.	16
IV	**Legal Procedures, Forest Offences, and Protection Mechanisms** Code of Criminal Procedure (CrPC), 1973 – Definitions Position of forest offences Constitution and powers of criminal courts Important sections relevant to forest conservation Code of Civil Procedure (CPC), 1908 – Summons and discovery. Indian Penal Code (IPC), 1860 – Abetment of forest offences Offences directly connected with forests and forest produce Legal protection extended to Forest Officers Indian Evidence Act, 1872 – Application in forestry-related matters.	16
	Total	64

Textbooks:

1. Chaturvedi, A.N. 2011. Forest Policy and Law. Khanna Bandhu Publishers, Dehradun.
2. Negi, S.S. 1997. Forest Policy and Law, IBD, Dehradun.
3. Dutta, R. and Yadav, B. 2012. Supreme Court on Forest Conservation. Universal Law Publishing Co., New Delhi, India
4. 5. Ernakulam Shetty, B. J. 1985. A Manual of Law for Forest Officers, Sharda Press, Mangalore

5. Takwani, C. K. T and Thakker, M. C. (2012). Takwani Criminal Procedure. Lexis Nexis Butterwarths Wadhwa, Nagpur.

Paper II Major	**Plantation Forestry** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M502**

Course Objective:

This course aims to provide students intensive silvicultural practices for different forest plantations for obtaining higher utilizable biomass

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Recall the tools, equipment, and techniques used in plantation establishment and maintenance.	1
CO2	Explain the selection of species, planting methods, and aftercare practices for different types of plantations.	2
CO3	Apply knowledge of irrigation, fertilization, and tending operations to optimize plantation growth and productivity.	3
CO4	Analyze the economic considerations, financial planning, and comparative management of government and private plantations.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Plantation Forestry** Definition, scope, aims, and objectives of plantation forestry. Historical perspectives – Indian and global scenario. Role of plantations in meeting wood demand – Purpose, scale, and rate of plantation. Site selection – Factors determining species choice, tree species for different sites. Production technology for quality planting materials – Nursery techniques and mechanization in plantation establishment.	16
II	**Plantation Management and Silvicultural Practices** Planting program – Season, pattern, spacing, and methods. Post-planting activities – Tending, irrigation, nutrient management, and health monitoring. Stand dynamics – Stand density and growth development. Industrial and energy plantations – Models, species selection, precision silviculture. Plantations for timber, pulp, plywood, matchwood, and NTFPs. High-Density Short Rotation Forestry – Carbon sequestration, carbon credits, and CDM projects.	16
III	**Harvesting, Coppice Silviculture, and Plantation Economics** Harvesting types and patterns – Domestic, industrial, and export requirements. Harvesting operations – Delimbing, bucking, debarking, in-situ chipping, and transportation. Coppice silviculture – Principles, mechanisms, and management. Economics of plantations – Financial considerations and investment models.	16
IV	**Practical Plantation Management** Tools, equipment, and site preparation.	16

	Plantation visits – Management practices. Project planning, evaluation, and appraisal. Species selection, planting, and aftercare. Irrigation, fertilization, and tending operations. Plantation records, economics, and finance. Government vs. private plantations – Case studies.	
	Total	64

Textbooks:

1. Balasubramanian, A., Hari Prasath, C.N., Radhakrishnan, S. 2020. Textbook on Plantation Forestry. Jain Publication, New Delhi, p336.
2. Dwivedi, A.P. 1993. A. Text book of Silviculture, International Book Distributors, Dehra Dun.
3. Luna, R. K. 1989. Plantation Forestry in India. International Book Distributors, Dehradun.
4. Ram Prakash, R. 1998. Plantation and nursery technique of forest trees. International Book Distributors, Dehradun.
6. Evans, J. 1982. Plantation forestry in the tropics: Clarendon Press, Oxford, Oxford Science Publications, Oxford University Press.

Paper III Major	**Tree Improvement** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M503**

Course Objective:

This course aims to provide students a balanced and broad understanding of concepts and techniques related to tree breeding and tree improvement strategies.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Recall key concepts of tree breeding, genetic tests, and seed orchard management.	1
CO2	Explain selection methods, hybridization techniques, and genetic evaluation processes in tree improvement programs.	2
CO3	Apply knowledge of genetic variation, heritability, and experimental designs for tree breeding and evaluation.	3
CO4	Analyze genetic test results, seed orchard behavior, and the development of tree varietal descriptors.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Tree Breeding and Improvement** History and development of tree improvement. Objectives, advantages, and limitations of tree breeding. Key terminologies and major breeding programs in India & globally. Domestication, exotic species, and challenges in tree improvement. Reproductive systems – Pollination**, anthesis, and variation.**	16
II	**Breeding Methods and Hybridization** Selection methods – Mass selection, pure line, plus tree selection. Hybridization – Types, genetic consequences, and heterosis. Natural hybrids – Occurrence, determination, and future prospects. Mating design – Types, advantages, and genetic parameters. Genetic tests – Provenance, progeny, seed source, and clonal tests.	16

III	**Variety Development and Testing** Experimental design – RBD, genotype-environment interactions. Tree variety release – Procedures and protocols. PPVFRA – Breeder's, farmer's, traditional, and tribal varieties. DUS testing – Guidelines, procedures, and recent advancements. Development of tree descriptors and testing centers.	16
IV	**Practical** Selection methods for tree improvement programs. Hybridization – Interspecific & intraspecific evaluation. Controlled breeding – Genetic variation & heritability. Genetic tests – Provenance, progeny, seed source, and clonal tests. Experimental design – RBD & genetic test analysis. Seed orchards – Genetic behavior & management. Forest genetic resources & progeny evaluation visits. Developing descriptors for tree varietal registration.	16
	Total	64

Textbooks:

1. Bruce Zobel and John Talbert. 1984. Applied Forest Tree Improvement. John Wiley and Sons, New York. pp504.
2. Parthiban, K.T., N. Krishna Kumar and P.S. Devanand. 2020. Tree Breeding and Improvement Theory and Technology. Scientific Publishers (India), Jodhpur, India (ISBN No.: 978-93- 89412-83-3).
3. Surendran, C., R.N. Sehgal and M. Paramathma. 2003. Forest Tree Breeding. ICAR, New Delhi. P. 204.

Paper Minor	**Farming based livelihood systems** **L-T-P-C: 3-1-0-4 Credit Unit: 4 Evaluation Scheme: T**	**Course Code FOR142N501**

Course Objective:

This course aims to disseminate the knowledge and skill how farming-based systems can be a source of livelihood.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Recall the key concepts of agricultural livelihood systems, farming systems, and related indicators.	1
CO2	Explain the components of various farming systems and their contribution to rural livelihoods.	2
CO3	Apply knowledge of farming systems integration and livelihood models across diverse agro-climatic zones.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Agricultural Livelihood Systems in India** Status of agriculture in India & different states. Income & livelihood patterns of farmers & rural communities. Indicators for studying livelihood systems.	16

II	**Farming Systems & Livelihood Approaches** Agricultural livelihood systems (ALS) – meaning & framework. Traditional & modern farming systems in India. Components: Crops, livestock, horticulture, agroforestry, aquaculture, & secondary enterprises.	16
III	**Integration & Feasibility of Farming Systems** Factors affecting integration of farming enterprises. Feasibility of different farming systems across agro-climatic zones. Commercial farming models (NABARD, ICAR, etc.). Case studies on farming-based livelihood enterprises.	16
IV	**Policies, Risks & Future Prospects** Government schemes & programs for farming livelihoods. Public & private organizations promoting farming-based livelihoods. Risks, success factors & role of farming in circular & green economy. Impact of climate change, digitalization & lifestyle changes on farming livelihoods.	16
	Total	64

Textbooks:

1. Reddy, S.R. 2016. Farming System and Sustainable Agriculture, Kalyani Publishers, New Delhi.
2. Panwar et al. 2020. Integrated Farming System models for Agricultural Diversification,
3. Enhanced Income and employment, Indian Council of Agricultural Research, New Delhi.
4. Singh, J.P., et al. 2015. Region Specific Integrated Farming System Models, ICAR-Indian Institute of Farming Systems Research, Modipuram.
5. Walia, S. S. and U. S. Walia, 2020. Farming System and Sustainable Agriculture, Scientific Publishers, Jodhpur, Rajasthan.

B. Sc. Course in Forestry: Semester-VI

Paper I Major	**Forest Biotechnology** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M601**

Course Objective:

This course aims to provide students with the knowledge on the principles, tools, possibilities and progress made in biotechnology.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand plant tissue culture concepts, media preparation, and sterilization techniques.	1
CO2	Learn plant tissue culture techniques like shoot tip, meristem tip, and callus culture.	2

CO3	Apply genetic transformation methods like biolistic and Agrobacterium-mediated transformation.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Plant Tissue Culture and Biotechnology** Concepts, history, and scope of plant tissue culture. Media components, sterilization techniques, and factors affecting in vitro cultures. Regeneration methods: morphogenesis, organogenesis, and embryogenesis. Techniques in plant tissue culture: micropropagation, meristem tip culture, somatic embryogenesis, protoplast fusion, and secondary metabolite production.	16
II	**Genetic Engineering and Molecular Biology Techniques** Introduction to biotechnology and its role in crop improvement. Direct and indirect gene transfer methods in plants: Agrobacterium**,** microinjection, particle bombardment.	16
III	**Applications of Plant Biotechnology and Genetic Engineering in Forestry** Micropropagation in forest trees: bamboo, eucalyptus, sandalwood, and others. Bioprospecting industrially useful compounds from forest trees. Molecular markers in forestry and applications in genetic improvement. Role of genetic engineering in improving traits like resistance to pests, diseases, and abiotic stress in forestry species.	16
IV	**Biotechnology Laboratory Techniques** **Basics of lab setup, safety, and sterilization.** Media preparation, shoot tip, meristem tip, and callus culture; hardening of plants. Biolistic and Agrobacterium-mediated transformation. Field Visit: Plant Biotechnology Lab/Commercial Tissue Culture facility.	16
	Total	64

Textbooks:

1. Brown, T. A. 2010. Gene Cloning and DNA Analysis: An Introduction, 6th edn, Wiley-Blackwell Companion site
2. Krebs, J.E, Goldstein, E.S, Kilpatrick, S.T. 2017. Lewin's Genes XII. Jones and Bartlett Publishers, Inc., p.838
3. Malacinski, GM (2015) Freifelder's Essentials of Molecular Biology (4th Student edn) Jones and Bartlett Publishers, Inc.
4. Nelson D.L and M.M. Cox. 2017. Lehninger Principles of Biochemistry, (7th edn) W. H. Freeman and Company, New York, USA. p.1328.

Paper II Major	**Forest Economics and Marketing** **L-T-P-C: 2-1-0-4 Credit Unit: 4 Evaluation Scheme: T**	**Course Code FOR142M602**

Course Objective:

This course aims to exposure to the students on market concepts, marketing of forestry commodities, intermediaries involved, risks in forestry marketing, marketing institutions involved, price dynamics and the role of Government in regulation of markets

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define and explain key economic principles and their applications in forestry.	1
CO2	Apply utility theory and equilibrium analysis to real-world scenarios.	2
CO3	Calculate elasticity, price spread, and assess market equilibrium in forestry products.	3
CO4	Estimate costs, farm financial ratios, and prepare bankable projects for forestry products.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Economics and Forest Economics** Definition and concepts of economics, divisions, and economic systems. Forest economics: Characteristics, role in economic development, and national income (GNP & GDP). Consumer behavior: Utility theory, law of diminishing marginal utility, and consumer equilibrium.	16
II	**Market Structures and Marketing of Forest Products** Demand theory: Law of demand, elasticity, and Engel's law. Marketing functions: Producer surplus, marketing channels, price determination, and market equilibrium. Forest products: Marketing efficiency, integration, and forecasting in various market structures.	16
III	**International Trade and Financial Management** International trade: Concepts, free trade, WTO, and Free Trade Agreements. Project preparation: Bank norms, crop insurance, SWOT analysis, and financial analysis. Role of institutions: APEDA, MPEDA, ITTO, and their impact on agriculture.	16
IV	**Forest Products Economics & Market Analysis** Consumer Equilibrium: Utility approaches. Demand & Supply: Elasticity calculations. Production: Marginal returns and optimal output. Cost Estimation: Cultivation and production costs. Project Preparation: Bankable forestry projects. Financial Ratios: Farm financial analysis. Market Analysis: Surplus, price spread, and market structure. Market Research: Index numbers and market visits.	16
	Total	64

Textbooks:

1. Acharya S.S. and Agarwal NL. 2011. Agricultural Marketing in India. Fifth Edition. Oxford and IBH Publishers, New Delhi
2. Chadra P. 1984. Projects: Preparation, Appraisal and Implementation, McGraw Hill Inc.
3. Charya SS and Agarwal NL. 2011. Agricultural Marketing in India. Fifth Edition. Oxford and IBH Publishers, New Delhi.

4. Dewett K. K. 2005. Modern Economic Theory. S. Chand and Company, New Delhi.

Paper III Major	Remote Sensing and GIS Applications L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P	Course Code FOR142M603

Course Objective:

This course aims to enable the students to know about the remote sensing methods and applications in NRM, digital image processing and concepts of GIS and data management

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Understand remote sensing and GIS hardware and software.	1
CO2	Apply GIS techniques in map digitization and data editing.	2
CO3	Interpret aerial photographs and satellite imagery for resource management.	3
CO4	Conduct GIS-supported case studies for water resources management.	4

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	Introduction to Remote Sensing and Data Acquisition Basics of Remote Sensing (RS), advantages, and limitations Electromagnetic spectrum, energy interactions, and major atmospheric windows Spectral reflectance curves for vegetation, soil, and water Sensors and platforms: Types and functions; aerial photography and photogrammetry basics Aerial photo interpretation and stereoscopic vision	16
II	**Satellite Remote Sensing and Image Analysis** Satellite remote sensing techniques: Multispectral scanners, whiskbroom, and push-broom scanners Image analysis: Digital data restoration, enhancement, and information extraction Image classification: Unsupervised and supervised classification methods Vegetation indices and microwave remote sensing basics	16
III	**GIS and Applications in Resource Management** Basic components of GIS: Spatial data, map projections, and data input methods Data editing, spatial data models, and attribute data management GIS data integration (map overlay) for land and water resources management Applications of remote sensing and GIS in environmental monitoring and resource management	16
IV	**Remote Sensing and GIS Applications in Resource Management** Familiarization with remote sensing and GIS hardware Software for image interpretation and aerial photograph/satellite imagery analysis	16

	Basic GIS operations: Image display, scanning, digitization, and data editing Database query and map algebra GIS-supported case studies in water resources management	
	Total	64

Textbooks:

1. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
2. George, J. 2005. Fundamentals of Remote Sensing. 2nd Edn. Universities Press (India) Private Limited, Hyderabad.
3. Jensen, J. R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
4. Lillesand, T., Kiefer, R. W. and Chipman, J. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.

Paper IV Major	**Forest Tribology, Ethnomedicine and Extension** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M604**

Course Objective:

This course aims to impart basic knowledge on local indigenous peoples their knowledge on ethno medicines and the extension skills and knowledge with reference to forestry.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Learn key concepts in tribology related to forest management.	1
CO2	Study tribal plant-based medicines and their uses.	2
CO3	Examine forest products' role in tribal livelihoods.	3
CO4	Implement extension methods for tribal welfare and rural development.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Tribes and Forests** Definition and characteristics of tribes, tribal economy, and racial classification. Tribes in India, with focus on North East India and Assam. Tribal identity, integration issues, and tribal welfare in India. Relationship between tribes and forests, role of forest resources in their livelihood. Forest management and conflicts, role of forest department and tribal welfare.	16
II	**Ethno-Medicine and Traditional Knowledge** Ethno-medicines of tribals in Northeast India, particularly traditional botanical knowledge. Medicinal plants from families: Guttiferae, Malvaceae, Fabaceae, Rubiaceae, etc. Role of Non-Wood Forest Products (NWFPs) in tribal economy. Social forestry and tribal welfare through forest resources.	16

III	**Extension Education and Rural Development** Introduction to extension education, its nature, scope, and objectives. Rural development concepts, objectives, and technology transfer programs like RD, KVK, OFT, FLD. ICT-enabled extension services and communication models. Participatory Rural Appraisal (PRA) and evaluation techniques. Rural social groups and their roles in development.	16
IV	**Field Visits and Practical Training** Study KVKs, ICFRE institutes, and local governance functions. Prepare village-level production plans, charts, and posters. Participate in exhibitions, method demos, and PRA exercises. Visit tribal regions for ethnobotanical knowledge and plant identification. Collect and prepare herbarium specimens of medicinal and social plants.	16
	Total	64

Textbooks:

1. FAO. 1984. Forestry extension, making it works, An international journal of forestry and forest industries, Unasylva - No. 143, Published by FAO.
2. Furer-Haimendorf, C.V. 1985. Tribes of India - the struggle for survival. OUP. New Delhi Hasnain, N. 2007. Tribal India. New Royal Book Company
3. K.A. Jalihal and V. Veerabhadraiah. 2007. Fundamentals of Extension Education and Management in Extension, Concept Publishing Company.
4. L.K. Jha and P. K. Sen Sarma, A.P.H. 2008. A Manual of Forestry Extension Education, Published by VEDAMS, P. 386 p.

Paper Minor	**Forest Entrepreneurship and Business Management** **L-T-P-C: 3-1-0-4 Credit Unit: 4 Evaluation Scheme: T**	**Course Code FOR142N601**

Course Objective:

This course aims to provide the students an insight into the concept and scope of entrepreneurship and develop financially viable agribusiness proposal.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand key concepts and characteristics of entrepreneurship.	1
CO2	Identify opportunities and develop skills for enterprise planning and management.	2
CO3	Analyze the factors influencing product/service selection and business formulation.	3
CO4	Apply financial, production, and marketing management techniques in entrepreneurship.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**

I	**Introduction to Entrepreneurship** Concepts and importance of entrepreneurship Characteristics and competencies of entrepreneurs Evolution and types of entrepreneurs Environmental and social factors affecting entrepreneurship Infrastructure, support systems, and financial institutions	16
II	**Enterprise Planning and Development** Opportunity identification and environmental scanning Product/service selection, registration, and ownership forms Project identification, selection, and formulation Planning, capital sources, and enterprise management	16
III	**Enterprise Management and Marketing** Production management: quality control, cost, inventory, and raw materials Financial management: costing, pricing, bookkeeping, and taxation Marketing strategies and crisis management in enterprise Personal management: manpower planning, wages, and labor turnover	16
IV	**Practical** Visit to small scale industries/agro-industries, Interaction with successful entrepreneurs/ agric- entrepreneurs. Visit to financial institutions and support agencies. Preparation of project proposal for funding by different agencies.	16
	Total	64

Textbooks:

1. Charantimath P.M. 2009. Entrepreneurship Development and Small Business Enterprises. Pearson Publications, New Delhi.
2. Desai V. 2015. Entrepreneurship: Development and Management, Himalaya Publishing House.
3. Desai, Vasant 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House
4. Grover Indu. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy.

B. Sc. Course in Forestry: Semester-VII

Paper I Major	**Wood Science and Technology** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M701**

Course Objective:

This course aims to make students aware about the problems related to wood as basic material to manufacture various useful products

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the physical, mechanical, and chemical properties of wood and their impact on its applications.	1
CO2	Learn various wood processing techniques, including seasoning, preservation, and composite manufacturing.	2

CO3	Analyze the role of wood-based industries in the Indian economy and sustainable resource management.	3
CO4	Develop skills in wood testing, machining, and modern wood modification techniques for industrial applications.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	Wood Properties and Water Relationship Natural defects in wood Mechanical properties: tension, compression, bending, shearing Wood-water relationship: hygroscopic nature, moisture content, shrinkage, and swelling Determination of moisture content and fibre saturation point	16
II	**Wood Seasoning Techniques** Principles and importance of wood seasoning Methods: air seasoning, kiln seasoning, and chemical seasoning Special seasoning methods and control of seasoning defects Refractory classes of timbers and kiln schedules	16
III	**Wood Preservation and Treatment** Wood biodeterioration and classification based on durability Wood preservatives and their types: water-soluble, oil-based, fire retardants Methods of application: brushing, steeping, hot/cold bath, pressure methods Merits and demerits of different preservation techniques	16
IV	**Wood Testing, Seasoning, and Preservation** Mechanical tests: static bending, impact bending, compression, shear, torsion, hardness Moisture content determination and wood-water relationship Shrinkage, swelling, and combustibility estimation Non-destructive wood testing and lab visits Seasoning methods, scheduling, and safety aspects Wood preservation techniques: non-pressure and pressure methods	16
	Total	64

Textbooks:

1. Bowyer J. L., Shmulsky, R. and Haygreen, J. G. 2007. Forest products and wood science: An introduction. 5th Ed. Blackwell publishing, Ames, IA. 496p.
2. Brown, H. P. 1985. Manual of Indian wood technology. International books and periodicals supply service, New Delhi. 121 p.
3. Divya, M.P., Parthiban, K.T., Packialakshmi, M. and S. Krishnamoorthi. 2022. Text Book on Wood Products and Utilization. Scientific Publishers, Jodhpur (ISBN No.: 9789392590795).
4. FRI. [Forest Research Institute]. 1976. Indian forest utilization. Volume I and II. Forest Research Institute, Dehradun. 941p.
5. Panshin, A. J. and De Zeeuw, C. 1980. Textbook of wood technology, 4th Ed. McGraw-Hill. New York, USA: 722p.

Paper II Major	**Forest Biomass Energy and Biofuels** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M702**

Course Objective:

This course aims to make students aware about the need for forest-based bioenergy and biofuel towards creating self-reliance in raw material besides combating the climate change risks and uncertainties

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the types, availability, and potential of forest biomass for energy production.	1
CO2	Analyze biomass properties, conversion technologies, and their role in renewable energy.	2
CO3	Evaluate different biomass-based power generation methods, including pyrolysis, gasification, and combustion.	3
CO4	Apply knowledge of biofuel production processes, including transesterification and SAF production, for sustainable energy solutions.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Energy Status and Biomass Resources** Energy demand and supply in India Conventional vs. alternative energy sources National Policy on Biofuels (2018, 2022 Amendment) Biomass availability and types (agricultural residues, TBOs, algal feedstock, UCO, animal tallow) Challenges and constraints in biomass utilization	16
II	**Dendro Energy and TBOs** Scope and potential of dendro energy in India Properties, cultivation, and plantation models of dendro biomass High-Density Energy Plantation (HDEP) and harvesting methods Major TBO species and their cultivation (*Jatropha, Pongamia, Neem, Mahua, Simarouba*) Value chain and market potential of TBOs	16
III	**Biomass-Based Power and Biofuel Production** Biomass-based power generation (pyrolysis, gasification, combustion) Oil extraction from TBOs and transesterification for biodiesel production Hydroprocessing of Esters and Fatty Acids (HEFA) for SAF production Quality characteristics and applications of biodiesel and SAF	16
IV	**Dendro Energy and Biofuels** Dendro energy species & QPM production Biomass characterization & conversion Energy plantation models & processing Pyrolysis, gasification & combustion Biofuel crops & TBOs (Jatropha, Pongamia, Neem, etc.) Oil extraction, biodiesel & SAF production Industrial visits: Gasification unit, biomass plant, oil processing center	16
	Total	64

Textbooks:

1. Adams P, Bridgwater T, Langton L A, Ross A and Watson I. 2018. Biomass Conversion Technologies. Greenhouse Gas Balances of Bioenergy Systems. p134 (ISBN: 9780081010365).
2. Bajpai P. 2020. Biomass to Energy Conversion Technologies -The Road to Commercialization.Elsevier. P 204. (ISBN: 978-0-12-818400-4).

3. Hakem K R, Jawaid M and Rashid U. 2014. Biomass and Bioenergy - Processing and properties. Springer. P343. (ISBN : 978-3-319-07641-6).
4. Pande M and Bhaskarwar A N. 2012. Biomass conversion to Energy - The Interface of Biotechnology, Chemistry and Materials Science. Springer. p.468. (ISBN: 978-3-642-28418-2).

Paper III Major	**Watershed Planning and Management** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M703**

Course Objective:

This course aims to acquaint the students with different aspects of watershed planning and management including participatory approaches and also on the integrated watershed management practices

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Explain watershed characteristics, planning, and management principles.	1
CO2	Implement soil and water conservation methods for sustainable watershed development.	2
CO3	Analyze watershed data using GIS and remote sensing for planning and prioritization.	3
CO4	Design and evaluate watershed management projects with financial and environmental considerations.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Watershed Management** Watershed characteristics, classification, and codification Concepts, objectives, and principles of watershed management Factors affecting watershed planning, land capability classification Watershed delineation, prioritization, and sediment yield index	16
II	**Watershed Conservation and Management** Rainwater conservation: In-situ & ex-situ storage, water harvesting Dry farming techniques, cropping systems, and land management Integrated watershed management: Agriculture, forestry, fishery, and animal husbandry Community participation: SHGs, user groups, participatory rural appraisal	16
III	**GIS & Remote Sensing in Watershed Planning** Basics of Remote Sensing, GIS, and spatial data structures Delineation of watersheds, thematic map preparation, and HRU analysis Hydrological modeling: SWAT and other models Watershed evaluation, impact assessment, financial planning, and case studies	16
IV	**Watershed Planning and Management** Watershed delineation using toposheets and surveying techniques Preparation of watershed maps and quantitative analysis of watershed parameters Hydrologic data analysis, water budgeting, and sediment measurement Remote Sensing & GIS applications in watershed planning and prioritization	16

	Design and components of watershed structures (earth embankments, conservation measures) Role of stakeholders in watershed programs and financial management Field visits to watershed development project areas	
	Total	64

Textbooks:

1. Das, G. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd edn. Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
2. Katyal, J. C., Singh, R. P., Sharma, S., Das, S. K., Padmanabhan, M. V. and Mishra, P. K. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
3. Mahnot, S. C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
4. Rajora, R. 2019.Integrated Watershed Management. Rawat Publications, New Delhi.
5. Sharda, V. N., Sikka, A. K. and Juyal, G. P. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.

Paper IV Major	**Industrial Agroforestry** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M704**

Course Objective:

This course aims to develop skills and expertise on Industrial Agroforestry and associated supply and value chain management.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Explain watershed characteristics, planning, and management principles.	1
CO2	Implement soil and water conservation methods for sustainable watershed development.	2
CO3	Analyze watershed data using GIS and remote sensing for planning and prioritization.	3
CO4	Design and evaluate watershed management projects with financial and environmental considerations.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Overview of Industrial Agroforestry** Extent and status of forests & agroforestry (National & International). Role of forests in industries – raw material demand & supply. Major wood-based industries in India – timber, pulpwood, plywood, etc. Policy and legal aspects of industrial plantations & agroforestry.	16
II	**Plantation Management & Value Addition** Industrial agroforestry plantations – preferred species & management.	16

	Precision silviculture techniques – propagation, pest & disease control. Harvesting operations – mechanization & yield potential. Value addition – utilization of plantation residues, briquettes & pellets.	
III	**Marketing, Business, & Environmental Impact** Supply chain & marketing of agroforestry products. Contract farming – concept, methods, & industry collaborations. Business innovations, CSR, and agroforestry entrepreneurship. Economic, ecological, and socio-environmental impacts – carbon sequestration & trading.	16
IV	**Industrial Agroforestry and Business Development** Study of timber, pulp & paper, plywood, matchwood, and dendro energy agroforestry. State-specific species for industrial agroforestry. Plantation Management: Techniques in harvest, mechanization, and value addition. Contract tree farming, economics, and project preparation. Practical Exposure: Visits to wood and non-wood based industries, business opportunities, and DPR preparation for agroforestry business models.	16
	Total	64

Textbooks:

1. Balasubramanian, A., Hari Prasath, C.N., Radhakrishnan, S. 2020. Textbook on Plantation Forestry. Jain Publication, New Delhi, p336.
2. Parthiban, K.T., R. Umarani, S. Umesh Kanna, I. Sekar, P. Rajendran and P. Durairasu. 2014.
3. Industrial Agroforestry: Perspective and Prospective. Scientific Publishers, Jodhpur, India. Pp:396.
4. Parthiban, K.T. and R. Seenivasan. 2017. Forestry Technologies- A complete Value Chain Approach. Scientific Publishers, Jodhpur. p 629.
5. Parthiban, K.T. and Keerthika, A. 2020. Textbook on Agroforestry – Principles, practices and Applications. Agrobios, Jodhpur, p256

Paper Minor	**Trees Outside Forest (TOF)** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142N701**

Course Objective:

This course aims to make the students understand the growing importance of trees outside forests

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Identify different types of Trees Outside Forests (TOF) and assessment methods.	1
CO2	Describe regeneration, restoration, and nursery management of TOF.	2
CO3	Apply market and agroforestry models to TOF management.	3

CO4	Analyze the economic, environmental, and certification impacts of TOF.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Trees Outside Forests (TOF) and Classification** Types of TOF based on land use and geometric formation (settlements, agricultural lands, natural features). FSI methods, stratified random sampling, and multistage stratified sampling. TOF status in India, state-wise analysis, and opportunities for wood and non-wood products.	16
II	**Regeneration, Restoration, and Nursery Management** Methods for quality planting material (QPM), design, development, and planting techniques. Design, components, and criteria for species selection. Timber and NTFPs, economic tree species, and models for agroforestry and farm forestry.	16
III	**Economic and Environmental Impact of TOF** Contribution to ecosystem services, carbon sequestration, and restoration of degraded lands. Global and national status, market size, demand-supply, processing, and value addition. National Forest Policy, National Agroforestry Policy, and regulations for market and trade channels.	16
IV	**TOF Certification, Carbon Trading, and Schemes** TOF Certification, Carbon Trading, and Schemes Certification and Standards: FSC, PEFC, SFI, IFWCC, and sustainable forestry initiatives. Carbon Sequestration and Trading: UNFCC, Kyoto Protocol, carbon credit, and opportunities for farmers. Schemes and Programs: National Bamboo Mission, Green Highways, GIM, NMOOP, and other related initiatives.	16
	Total	64

Textbooks:

1. Parthiban, K.T. and A. Keerthika. 2020. A textbook of Agroforestry: Principles, Practices and Applications. AgroBios (India), Jodhpur. P. 256 (ISBN: 978-81-973776-8-9).
2. Parthiban, K.T. and R. Seenivasan. 2017. Forestry Technologies- A Complete Value Chain Approach. Scientific Publisher. Jodhpur. P.629 (ISBN: 978-93-86102-60-7).
3. Parthiban, K.T., R. Jude Sudhagar, C. Cinthia Fernandaz and K.K. Suresh. 2018. Agroforestry strategies for climate change (Mitigation and adaptation). Jaya Publishing House, New Delhi. P. 395 (ISBN:978-93-86110-53-4).

B. Sc. Course in Forestry: Semester-VIII

Paper I Major	**Commercial Forest Product and Utilisation** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code FOR142M801**

Course Objective:

This course aims to provide students with the knowledge on the wood and wood panel related industries

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Identify various wood-based industries and their products.	1
CO2	Understand the primary conversion techniques and their applications.	2
CO3	Analyze the properties and uses of different wood composites.	3
CO4	Evaluate modern wood modification techniques for industry applications.	4

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Wood-Based Industries and their Role in the Economy** Growth and importance of wood-based industries in India. Overview of timber production, both roundwood and engineered wood. National and international trade in primary timber species. Status of wood and wood panel industries in India and globally. Different forest-based industries: Paper, Pulp, Furniture, Bamboo, and more.	16
II	**Wood Conversion and Processing Techniques** Primary conversion methods and sawing techniques. Wood machining tools: Parting, Slicing, Shaping, Measuring. Stages in wood working and wood joinery. Veneer production: Types, uses, grading, and storage. Modern technologies in furniture making, including CNC.	16
III	**Wood Composites and Modification Techniques** Production and applications of plywood, particle board, MDF, etc. Types of laminates: Matte, Textured, Gloss, PVC, Acrylic, and Bamboo. Eco-friendly composites: Lignocellulosic, Wood-Plastic, and Nano-based. Chemical and thermal wood modification: Acetylation, Furfurylation, and more. Bioactive composites and wood polymer production.	16
IV	**Wood Industry & Composites** Industry Visits: Explore sawmills, pulp/paper, furniture, plywood, and briquette industries. Wood Products: Study Particle board, MDF, Laminated Wood, and finishes like PVC, Acrylic. Composites: Learn about Wood Plastic and Inorganic Composites (WPCs, WIC). Wood Modification: Understand chemical and nanomaterial modifications for enhanced properties.	16
	Total	64

Textbooks:

1. Baldwin, R. F. 1981. Plywood manufacturing practices. Revised 2nd edn. Miller and Freeman Publication, Inc. USA. 388p.
2. FRI [Forest Research Institute]. 1976. Indian forest utilization. Volume I and II. Forest Research Institute and colleges, Dehradun. 941p.
3. Hoadley, B. 2000. Understanding Wood: A Craftsman's guide to wood technology. Taunton Press. Newtown, USA. 223p.