1.1.3

List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Name of the Subjects	Yellow	
Employability Contents	Green	
Entrepreneurship Contents	Light Blue	
Skill Development Contents	Pink	

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : ***Forestry ,Wildlife And Environmental Sciences***

Programme Name : ***B.Sc.***

Academic Year : 2023-24

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Sr. No.	Course Code	Name of the Course
01.	FOUATL1	Silviculture
02.	FOUATP1	Silviculture
03.	FOUBTL1	Fundamentals of Soil Science
04.	FOUBTP1	Fundamentals of Soil Science
05.	FOUCTL1	Forest Biometry
06.	FOUCTP1	Forest Biometry
07.	FOUCTL2	Forest Genetics and Tree Improvement
08.	FOUCTP2	Forest Genetics and Tree Improvement
09.	FOUDTL1	Tree Seed and Nursery Technology
10.	FOUDTP1	Tree Seed and Nursery Technology
11.	FOUDTL2	Forest Management
12.	FOUDTP2	Forest Management
13.	FOUDTL3	Forest Ecology and Ecosystem Analysis
14.	FOUDTP3	Forest Ecology and Ecosystem Analysis
15.	FOUDSI1	Attachment to Industries/Institutions/Villages
16.	FOUETL1	Application of RS & GIS in Forest and Watershed Management
17.	FOUETP1	Application of RS & GIS in Forest and Watershed Management

18.	FOUETL2	Wood Science and Technology
16.	FOUETP2	Wood Science and Technology
17.	FOUETL3	Forest Resource Management and Economics
18.	FOUETP3	Forest Resource Management and Economics
19.	FOUFTL1	Forest Protection
20.	FOUFTP1	Forest Protection
21.	FOUFTL2	Agroforestry and Tree Outside Forests
22.	FOUFTP2	Agroforestry and Tree Outside Forests
23.	FOUFTL3	Forest Products and Forest Based Industries
24.	FOUFTP3	Forest Products and Forest Based Industries
25.	FOUGTL1	Wildlife Management and Eco development
26.	FOUGTP1	Wildlife Management and Eco development
27.	FOUGTL2	World Forestry, Urban Forestry and Community Forestry
28.	FOUGTP2	World Forestry, Urban Forestry and Community Forestry
29.	FOUGTL3	Forest Policies, Acts and Legislation
31.	FOUGTP3	Forest Policies, Acts and Legislation
32.	FOUHTL1	Biostatistics and Research Methodology
33.	FOUHTP1	Biostatistics and Research Methodology
34.	FOUHDD1	Research Project/Dissertation
35.	FOUHTL1	Biostatistics and Research Methodology
36.	FOUHTP1	Biostatistics and Research Methodology
37.	FOUHTL2	Forest Business and Entrepreneurship Development
38.	FOUHTP2	Forest Business and Entrepreneurship Development
39.	FOUHSS1	Seminar
40.	FOUAML1	Introduction to Wildlife
41.	FOUAMP1	Introduction to Wildlife
42.	FOUBML1	Plantation Forestry
43.	FOUBMP1	Plantation Forestry

44.	FOUCML1	Earth Care Policy
45.	FOUCMP1	Earth Care Policy
46.	FOUDML1	Value Addition of NTFP
47.	FOUDMP1	Value Addition of NTFP
48.	FOUEML1	Commercial Nursery Production
49.	FOUEMP1	Commercial Nursery Production
50.	FOUFML1	Industrial Plantation
51.	FOUFMP1	Industrial Plantation
52.	FOUGML1	Environmental Audit
53.	FOUGMP1	Environmental Audit
54.	FOUHML1	Urban Forestry and Designing
55.	FOUHMP1	Urban Forestry and Designing
56.	FOUHML2	Ecotourism
57.	FOUHMP2	Ecotourism
58.	FOUAMDL1	Know Your Forest
59.	FOUASL1	Nursery Technology
60.	FOUASP1	Nursery Technology
61.	FOUAVL1	Environmental Education-I
62.	FOUBVL1	Environmental Education-II

Department **: *Forestry ,Wildlife and Environmental Sciences***

Programme Name **: *M.Sc.***

Academic Year **: *2023-24***

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

01.	FOPATT1	Advances in Silviculture
02.	FOPALT1	Advances in Silviculture
03.	FOPATT2	Forest Biotechnology & Tree Improvement
04.	FOPALT2	Forest Biotechnology & Tree Improvement
05.	FOPATT3	Forest Biometry, Surveying & Engineering
06.	FOPALT3	Forest Biometry, Surveying & Engineering
07.	FOPATT4	Forest Soil and Watershed Management
08.	FOPALT4	Forest Soil and Watershed Management
09.	FOPATT5	Wildlife Management and Conversation
07.	FOPALT5	Wildlife Management and Conversation
08.	FOPBTT1	Forest Management, Remote Sensing & GIS
10.	FOPBLT1	Forest Management, Remote Sensing & GIS
11.	FOPBTT2	Agro-forestry and Farm Forestry
12.	FOPBLT2	Agro-forestry and Farm Forestry
13.	FOPBTT3	Forest Product & Utilization
14.	FOPBLT3	Forest Product & Utilization
15.	FOPBTT4	Policy Acts and Legislation in Forestry, Wildlife and Environment
16.	FOPBLT4	Policy Acts and Legislation in Forestry, Wildlife and Environment
17.	FOPBTT5	Environment Management and Sustainability

18.	FOPBLT5	Environment Management and Sustainability
19.	FOPCTT1	Forest Protection
20.	FOPCLT1	Forest Protection
21.	FOPCTT2	Wood Science and Technology
22.	FOPCLT2	Wood Science and Technology
23.	FOPCTT3	Forest Ecology and Biodiversity Conservation
24.	FOPCLT3	Forest Ecology and Biodiversity Conservation
25.	FOPCTT4	Industrial Safety, Health and Environment
26.	FOPCLT4	Industrial Safety, Health and Environment
27.	FOPCTT5	Forest and People
28.	FOPCLT5	Forest and People
29.	FOPDTT1	Forest Statistics and Research Methodology
30.	FOPDLT1	Forest Statistics and Research Methodology
31.	FOPDPJ1	Dissertation

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2023-24

School : *School of Natural Science*

Department : Forestry, Wildlife & Environmental Sciences

Date and Time : 03.07.2023 at 11:30 am

Venue : Smart classroom

The scheduled meeting of members of the Board of Studies (BoS) of the Department of Forestry, Wildlife, and Environmental Sciences School of Studies of Natural Resources, Guru Ghasidas Vishwavidyalaya, Bilaspur was held on dated 03.07.2023 at 11:30 am in smart classroom to discuss and design the syllabus of B. Sc. (Forestry) 4 Years (8 semester) scheme as per NEP 2020 guidelines, M.Sc. Forestry and Environmental Sciences and Ph. D. course work curriculum and credit framework/ syllabus as per LOCF guidelines. External Expert has joined the meeting through online mode. The following members of BOS were present in the meeting:-

The following members were present in the meeting:

1. Prof. Manmohan Dobriyal (External Expert Member BoS, Rani Laxmi Bai Central Agricultural University, Jhansi.)
3. Prof. K. K. Chandra (HOD, Associate Prof., Dept. of Forestry, Wildlife and Environmental Sciences.-cum Chairman, BOS)
4. Prof. S.C. Tiwari (Member BoS, Associate Professor, Dept. of Forestry, Wildlife and Environmental Sciences)
5. Prof. S. S. Dhuria (Member, Associate Professor, Dept. of Forestry, Wildlife and Environmental Sciences)
6. Dr. Bhavana Dixit (Member, Assistant Professor, Dept. of Forestry, Wildlife and Environmental Sciences)

Scheme and Syllabus

Curriculum and Credit Framework- NEP 2020

FOR

B.Sc. FORESTRY

(w.e.f. Academic session:2023-24)

"SCHOOL OF NATURAL RESOURCES"

DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES

GURU GHASIDAS VISHWAVIDYALAYA

(A Central University established by the Central University Act.2009 No. 25 of 2009)

BILASPUR-495009, CHHATTISGARH

Course Structure and Credit Distribution

B.Sc. Forestry

(4 Year Course)

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
I	Major-01	FOUATL1	Silviculture	3	3	100
	Major-01 Practical	FOUATP1	Silviculture	1	2	100
	Minor-01		Drawn From the University pool	3	3	100
	Minor-01 Practical			1	2	100
	Multidisciplinary-01		Drawn From the University pool	3	3	100
	Ability Enhancement Course (AEC-01)		Drawn from the University Pool	2	2	100
	Skill Enhancement Course (SEC-01)		Drawn From the University pool	3	3	100
	Value added course-01		Drawn From the University pool	2	2	100
	Value added course-02		Drawn From the University pool	2	2	100
	TOTAL			**20**	**22**	**900**
II	Major -02	FOUBTL1	Fundamentals of Soil Science	3	3	100
	Major -02 Practical	FOUBTP1	Fundamentals of Soil Science	1	2	100
	Minor -02		Drawn From the University pool	3	3	100
	Minor -02 Practical			1	2	100
	Multidisciplinary-02		Drawn From the University pool	3	3	100
	Ability Enhancement Compulsory (AEC-02)		Drawn from the university pool	2	2	100

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	Skill Enhancement Course (SEC-02)		Drawn From the University pool	3	3	100
	Value added course-03		Drawn From the University pool	2	2	100
	Value added course-04		Drawn From the University pool	2	2	100
	TOTAL			**20**	**22**	**900**
	Summer Internship (Compulsory for 1 Year Certificate course)			4		100

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
III	Major -03	FOUCTL1	Forest Biometry	3	3	100
	Major -03 Practical	FOUCTP1	Forest Biometry	1	2	100
	Major -04	FOUCTL2	Forest Genetics and Tree Improvement	3	3	100
	Major -04 Practical	FOUCTP2	Forest Genetics and Tree Improvement	1	2	100
	Minor -03		Drawn From the University pool	3	3	100
	Minor -03 Practical			1	2	100
	Multidisciplinary-03		Drawn From the University pool	3	3	100
	Ability Enhancement Course (AEC-03)		Drawn From the University Pool	2	2	100
	Skill Enhancement Course (SEC-03)		Drawn From the University Pool	3	3	100
	Total			**20**	**23**	**900**
IV	Major -05	FOUDTL1	Tree Seed and Nursery Technology	4	4	100
	Major -05 Practical	FOUDTP1	Tree Seed and Nursery Technology	1	2	100
	Major -06	FOUDTL2	Forest Management	4	4	100
	Major -06 Practical	FOUDTP2	Forest Management	1	2	100
	Major -07	FOUDTL3	Forest Ecology and Ecosystem Analysis	3	3	100

	Major -07 Practical	FOUDTP3	Forest Ecology and Ecosystem Analysis	1	2	100
	Minor -04		Drawn From the University Pool	3	3	100
	Minor -04 Practical			1	2	100
	Ability Enhancement Course (AEC-04)		Drawn From the University Pool	2	2	100
	Summer Internship (Compulsory for all)	FOUDSI1	Attachment to Industries/Institutions/Villages	Non credit		100
	TOTAL			**20**	**24**	**1000**
	Summer Internship (Compulsory for 2 Year Diploma course)			4		100
V	Major -08	FOUETL1	Application of RS & GIS in Forest and Watershed Management	4	4	100
	Major -08 Practical	FOUETP1	Application of RS & GIS in Forest and Watershed Management	1	2	100
	Major -09	FOUETL2	Wood Science and Technology	4	4	100
	Major -09 Practical	FOUETP2	Wood Science and Technology	1	2	100
	Major -10	FOUETL3	Forest Resource Management and Economics	4	4	100
	Major -10 Practical	FOUETP3	Forest Resource Management and Economics	1	2	100
	Minor- 05		Drawn From the University pool	3	3	100
	Minor - 05 Practical			1	2	100
	Internship	FOUEII1		2	-	100
	TOTAL			**21**	**23+**	**900**
VI	Major -11	FOUFTL1	Forest Protection	4	4	100
	Major -11 Practical	FOUFTP1	Forest Protection	1	2	100
	Major -12	FOUFTL2	Agroforestry and Tree Outside Forests	4	4	100
	Major -12 Practical	FOUFTP2	Agroforestry and Tree Outside Forests	1	2	100
	Major -13	FOUFTL3	Forest Products and Forest Based Industries	4	4	100

	Major -13 Practical	FOUFTP3	Forest Products and Forest Based Industries	1	2	100
	Minor- 06		Drawn From the University pool	3	3	100
	Minor- 06 Practical			1	2	100
	TOTAL			**19**	**23**	**800**
VII	Major -14	FOUGTL1	Wildlife Management and Eco development	4	4	100
	Major -14 Practical	FOUGTP1	Wildlife Management and Eco development	1	2	100
	Major -15	FOUGTL2	World Forestry, Urban Forestry and Community Forestry	4	4	100
	Major -15 Practical	FOUGTP2	World Forestry, Urban Forestry and Community Forestry	1	2	100
	Major -16	FOUGTL3	Forest Policies, Acts and Legislation	4	4	100
	Major -16 Practical	FOUGTP3	Forest Policies, Acts and Legislation	1	2	100
	Minor- 07		Drawn From the University pool	3	3	100
	Minor- 07 Practical			1	2	100
	TOTAL			**19**	**23**	**800**
	Seminar (only for 4 years Honours course)			1		100
VIII (4 Year Honours with Research)	Major -17	FOUHTL1	Biostatistics and Research Methodology	4	4	100
	Major -17 Practical	FOUHTP1	Biostatistics and Research Methodology	1	2	100
	Minor- 08		Drawn From the University pool	3	3	100
	Minor- 08 Practical			1	2	100
	Research Project/Dissertation	FOUHDD1	Research Project/Dissertation	12	-	100
			Total	**21**		**500**

	GRAND TOTAL CREDITS			**160**		
VIII (4 Year Honours course)	Major -17	FOUHTL1	Biostatistics and Research Methodology	4	4	100
	Major -17 Practical	FOUHTP1	Biostatistics and Research Methodology	1	2	100
	Major -18	FOUHTL2	Forest Business and Entrepreneurship Development	4	4	100
	Major -18 Practical	FOUHTP2	Forest Business and Entrepreneurship Development	1	2	100
	Minor- 08		Drawn From the University pool	3	3	100
	Minor- 08 Practical			1	2	100
	Minor- 09		Drawn From the University pool	3	3	100
	Minor- 09 Practical			1	2	100
	Seminar	FOUHSS1	Seminar	2	2	100
			Total	**20**		**900**
GRAND TOTAL CREDITS				**160**		

Minor Courses offered by Department of Forestry Wildlife and Eavironmental Sciences

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
I.	MINOR-1	FOUAML1	Introduction to Wildlife	3	5	100
	MINOR-1 (Practical)	FOUAMP1	Introduction to Wildlife	1		100
II.	MINOR-2	FOUBML1	Plantation Forestry	3	5	100
	MINOR-2 (Practical)	FOUBMP1	Plantation Forestry	1		100
III.	MINOR-3	FOUCML1	Earth Care Policy	3	5	100
	MINOR-3 (Practical)	FOUCMP1	Earth Care Policy	1		100

IV.	MINOR-4	FOUDML1	Value Addition of NTFP	3	5	100
	MINOR-4 (Practical)	FOUDMP1	Value Addition of NTFP	1		100
V.	MINOR-5	FOUEML1	Commercial Nursery Production	3	5	100
	MINOR-5 (Practical)	FOUEMP1	Commercial Nursery Production	1		100
VI.	MINOR-6	FOUFML1	Industrial Plantation	3	5	100
	MINOR-6 (Practical)	FOUFMP1	Industrial Plantation	1		100
VII.	MINOR-7	FOUGML1	Environmental Audit	3	5	100
	MINOR-7 (Practical)	FOUGMP1	Environmental Audit	1		100
VIII.	MINOR-8	FOUHML1	Urban Forestry and Designing	3	5	100
	MINOR-8 (Practical)	FOUHMP1	Urban Forestry and Designing	1		100
	MINOR-9	FOUHML2	Ecotourism	3	5	100
	MINOR-9 (Practical)	FOUHMP2	Ecotourism	1		100

Multidisciplinary Courses offered by Department of Forestry Wildlife and Environmental Sciences

Sl. No.	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
1.	MULT-01	FOUAMDL1	Know Your Forest	3	3	100

Skill Enhancement Courses offered by Department of Forestry Wildlife and Environmental Sciences

Sl. No.	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
1	SEC-01	FOUASL1	Nursery Technology	2	4	100
	SEC-01 (Practical)	FOUASP1	Nursery Technology	1		100

Value Added Courses offered by Department of Forestry Wildlife and Environmental Sciences

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
I	VAC-01	FOUAVL1	Environmental Education-I	2	2	100
II	VAC-03	FOUBVL1	Environmental Education-II	2	2	100

Graduates Attributes

Graduates Attributes (GAs) are measurable outcomes that signify the capabilities and potentials of the graduate to attain accomplishment and perform in adequate manner at appropriate situations. Following are the Graduate Attributes of B. Sc. Forestry are given as below:

PO1. Acquaintance with the subject knowledge: Gain in-depth knowledge and understandings of each discipline or professional area across boundaries of nations with an aptitude to identify, access, analyze and synthesize existing and new knowledge, and integrate them for enrichment of knowledge.

PO2. Analytical ability: ability to analyze and address multifaceted scientific issues in forestry, wildlife and environmental sciences; pertain and take independent decision for synchronizing information to formulate innovative and intellectual advances towards focused research over theoretical and different domains of forestry and allied sciences.

PO3. Application of modern tool and techniques: Select, learn and apply appropriate techniques, resources, sophisticated instruments, RS and GIS all knowledge for explaining different forestry operational activities, wildlife management and environmental ICT tools, consequences and mitigation activities with a thorough understanding.

PO4. Problem Solving: Address and solve scientific vis-a-vis environmental problems via rational and original thinking; keep updates of different solution avenues and select appropriate options considering public health, cultural, and societal factors.

PO5. Multidisciplinary competence: Develop sound knowledge and perception initiatives and leadership in collaborative-multidisciplinary and trans-disciplinary scientific research, demonstrate a capacity for self-management and teamwork, achieving common goals and objectives; motivate group members to address different issues on forestry, wildlife and environmental stability with scientific temperament.

PO6. Communication skill: Ability to communicate scientific/technological knowledge and new learning to the scientific community and the society at large with strong conviction and confidence. This can be achieved through sound technical proficiency of computing skill, training of software's, writing skills, in-depth subject specifics knowledge.

PO7. Ethical values and moral values: Attain strong academic integrity, professional code of conduct, ethics of experimental research and scientific writings, contemplation of the impact of research findings on conventional issues, and a sense of responsibility towards societal needs for attaining inclusive and sustainable development goals.

PO8. Futuristic approach: Ability to recognize and address current issues of forestry and environment in changing world with a futuristic view and practicing intuitiveness and interest towards scientific prediction via application of basic knowledge of science especially with regard to India's SDGs and national action plan for GHG emission and sustainable development.

Program Specific Outcomes of B.Sc. Forestry

PSO1	To develop undergraduate level student strong competencies in the field of Forestry and its application in a technology-rich, interactive environment.
PSO2	To develop strong student skills in silvicultural activities, forest survey & mapping, forest management planning, forest operation, urban forestry, forestbased industries development and value addition, IPR applications, natural resource management, environmental sustainability, socio economic stability, data collection and analysis by using new techniques and tools.
PSO3	Apply knowledge and skill in the development of forest and forestry activities to compete for employment in Forestry and its allied disciplines to meet the fulfillment of government and industrial needs.
PSO4	Become trained in the areas of forestry and ready for handling complex issues of forest management for sustainable development in the changing World.

SEMESTER – I

PAPER-I: SILVICULTURE **(Major-01)** **CR: 3+1**

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUATL1 FOUATP1	3	-	1	5 hours	30	70	100	200	4

Objectives:

1. To provide knowledge about forest tree nursery production, site factors, forest types, different tree species planting methods and forest regeneration.
2. The course makes students to identify forest and tree species, their distribution, and vegetation structure, locality factor, etc.
3. To provide information how to conduct regeneration survey and its analysis for vegetation.
4. The subject provides information related to cultural operations like tending operation, pruning, climber cutting etc.

Theory

Definition, objectives and scope of silviculture, status of forest cover of India. Taxonomy and tree identification. Major forest types of India –forest composition and structure. Locality factors influencing forest growth and distribution in India. Seed collection, Natural and Artificial regeneration. Nursery techniques. Tending operations. Plantations methods and geometry. Silvics of important forest tree species- *Cedrus deodara, Pinus roxburghii, Shorea robusta, Tectona grandis, Terminalia species, Dalbergia species, Bamboo species etc.*

Practical

Study of Composition of nearby forest areas and know the different species, Phenological study of some important tree species, Seed identification and sowing methods. Regeneration survey of mixed and pure forests, visit to different sites to study silvicultural operations, Nursery operations, Survey of the local vegetation.

Suggested Readings:

1. Champman, G.W. and Allan, T.G. (1978). Establishment Techniques for Forest Plantation F.A.O Forestry Paper No.8. F.A.O Rome.
2. Dwivedi, A.P. (1993). A Text Book of Silviculture, International Book Distributors, Dehradun.
3. Khanna, L. S. (1984). Principles and Practice of Silviculture, Khanna Bandu, Dehra Dun.
4. Negi, S.S. (1983), General Silviculture, Bisen Singh Mahendra Pal Singh, 23 A Connaught Place Dehradun.

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5. Ram Prakash and L.S. Khanna. (1991) Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun.
6. Chandra KK and Rajesh Kumar (2022) Forestry Practical (A complete practical solution for students), Scientific Publishers, Jodhpur, India, ISBN 97893914118366

Course Outcomes:

CO1: Course will enrich the knowledge of students related to forest nursery production and forest types, different tree species and forest survey.

CO2: The course makes students to identify forest and tree species, their distribution, and vegetation structure.

CO3: Students will be able to conduct experiment on seed dormancy, forest regeneration survey and its analysis for vegetation.

CO4: Student will able to perform cultural operations like teeding operation, pruning, climber cutting etc. in a forest stand.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	-	-	2	3	3	3	3	3	2
CO2	3	2	3	-	-	2	3	3	3	3	3	2
CO3	3	2	3	-	-	2	3	3	3	3	3	2
CO4	3	2	3	-	-	2	3	3	3	3	3	2

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-II: MINOR PAPER (Minor-01) CR: 3+1
Drawn From the University pool

PAPER-III: MULTIDISCIPLINARY (MTD-01) CR: 3
Drawn From the University pool

PAPER-IV: ABILITY ENHANCEMENT COURSE (AEC-01) CR :2
Drawn From the University pool

PAPER-V: SKILL ENHANCEMENT COURSE (SEC-01) CR: 3
Drawn From the University pool

PAPER-VI: VALUE ADDED COURSE (VAC-01) CR: 2
Drawn From the University pool

PAPER-VII: VALUE ADDED COURSE (VAC-02) CR: 2

Drawn From the University pool

SEMESTER – II

PAPER-I: FUNDAMENTALS OF SOIL SCIENCE (Major- 02) CR: 3+1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUBTL1 FOUBTP1	3	-	1	5 hours	30	70	100	200	4

Objectives:

1. To provide practical knowledge about soil, components and their properties with relation to forest growth and environment.
2. To provide students exposure on soil formation processes and its role in forest nutrient dynamics.
3. It will provide knowledge about soil, fertilizers, biofertilizers and nutrient management in different ecosystem.
4. Course will develop the ability of student in soil testing and site evaluation for establishing forest plantation.

Theory

Concepts of soil and soil science, Composition of Earth crust and its relationship with soils. Weathering and Soil formation, soil classification; Soils of India; Forest soils – distinguishing features; soil physical and chemical properties; Forest soil organic matter, Decomposition, nutrient cycling. Mineral Transformation-carbon cycle, nitrogen cycle, Phosphorous cycle, Sulphur cycle. Bio-fertilizers, Soil biota, Soil fertility, Essential plant nutrients, Mycorrhizal forest associations, soil degradation, management interventions of forest soils.

Practical

Study on soil profile. Soil Collection and Processing techniques, estimation of soil pH, bulk density, porosity, moisture, texture, nitrogen, phosphorus, potassium, organic carbon and organic matter. Study of common microorganisms in different ecosystems.

Suggested Readings:

1. Armson, K.A. Forest Soils, (1977). IBD Publisher, Dehradun.
2. Biswas, T.D. and S.K. Mukherjee (2001). Text book of soil Science. Tata Mc. Grew Hill, Publishing Co., New Delhi.
3. Brady, N. Cand Weil, R.R. (2009). Nature and properties of Soil. Prentice Hall of India.
4. Das, D.K (2013) Introductory Soil Science. Kalyani publishers.
5. Gaurav, Shalendra Singh (2015), Soil Science, DBS Imprints.

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6. Havlin J.L. and Tisdale S.L. (2013). Soil fertility and Fertilizers.Amazon.com
7. Kanwar, J.S. (1976). Soil Fertility – Theory and practice ICAR publication, New Delhi.
8. Mark Ashman and Geeta Puri (2008). A clear and concise introduction to soil science. Wiley-Blackwell publishers.
9. Plaster, Edward J., (2014), Soil Science and Management, Delmar Cengage Learning.

Course Outcomes:

CO1: Student's will able to differentiate between different soil types, its components and properties with relation to vegetation growth.

CO2: The students will be enhancing the knowledge about soil characteristics, soil –water relationships, soil fertility of different forest and its interaction with each other.

CO3: Graduates will understand the dynamics of soil nutrients and its relation with plants.

CO4: The student will develop skill related to soil testing, nutrient analysis and site evaluation for establishing forest plantation.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	3	3	-	3	3	3	1	2	2
CO2	2	2	3	2	2	-	2	2	3	2	2	2
CO3	3	2	3	3	3	-	3	3	3	1	2	2
CO4	3	3	3	3	3	-	3	3	2	3	3	2

Weightage:**1-Slightly;2-Moderately;3-Strongly**

PAPER-II: MINOR PAPER **(MINOR-02)** **CR: 3 + 1**
Drawn From the University pool

PAPER-III. MULTIDISCIPLINARY **(MTD-02)** **CR: 3**
Drawn From the University pool

PAPER-IV: ABILITY ENHANCEMENT COURSE **(AEC-02)** **CR: 2**
Drawn From the University pool

PAPER-V: SKILL ENHANCEMENT COURSE **(SEC- 02)** **CR: 3**
Drawn From the University pool

PAPER-VI: VALUE ADDED COURSE **(VAC-03)** **CR:2**
Drawn From the University pool

PAPER-VII: VALUE ADDED COURSE **(VAC- 04)** **CR:2**
Drawn From the University pool

SEMESTER – III

PAPER-I: FOREST BIOMETRY (Major- 03) **CR: 3 + 1**

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUCTL1 FOUCTP1	3	-	1	5 hours	30	70	100	200	4

Objectives:

1. To develop understanding of students about tree measurements, forest inventory, and yield concepts.
2. To apply biometric and dendrological measurement of individual trees and forests for forest stock and monetary estimation.
3. To design and implement comprehensive and appropriate forest resource inventories.
4. To enable skill job opportunities in forestry sectors.

Theory

Introduction, definition, objectives and scope of forest biometry. Units of measurement, standards of accuracy implied in their expression. Measurement of tree parameters- viz., diameter, height, volume. Stump and Stem analysis, Determination of tree age and dendrochronology for growth history and climate change studies. Estimation of growth and yield of individual tree and forest stands. Volume tables, yield and stand tables.

Forest inventory, sampling methods adopted in forestry. Measurement of crown density and crown ratios. Growth and yield prediction models – their preparation and applications.

Forest surveying tools and techniques.

Practical

Height, diameter, volume measurements, Calculations of volume of felled as well as standing trees, Volume table preparation, Preparation of yield and stand table, Quantification of regeneration and stand establishment, Measurement of crown density and crown ratios, Dendrochronological studies and tree ring analysis. Site Survey tools and techniques, Application of different sampling methods.

Suggested Readings:

1. Agrawal, Praveen, (2008), Forest mensuration- Tree measurement, Bisen Singh Mahendra Pal Singh, 23 A Connaught Place Dehradun.
2. Avery, T.E. (1967). Forest Measurements. Mc Grand Hill Book Company, New York.
3. Chaturvedi, A.N. and L.S. Khanna (1982). A handbook on Forest Mensuration. International Book Distributors
4. Donald Bruce Francis Schumcher, (2015), Forest Mensuration, Agrihorti Press New Delhi.

5. Hamilton, G.L. (1988). Forest Mensuration Handbook. Periodical Expert Book Agency.
6. Simmons CE. (1980). A Manual of Forest Mensuration. Bishen Singh Mahender Pal Singh, Dehradun.

Course Outcomes:

CO1: Students will develop knowledge about tree measurements, forest inventory, and yield concepts.

CO2: Student's ability to observe individual trees and forest crops for future yield.

CO3: Students will be able to develop and design forest resource inventories and forest survey.

CO4: Future job prospects to forestry and allied sectors.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1		2	3	3	3	3	3
CO2	3	3	3	3	1		2	3	3	3	3	3
CO3	3	3	3	2	1		2	3	3	3	3	3
CO4	3	3	3	3	1		2	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-II FOREST GENETICS AND TREE IMPROVEMENT (Major- 04) CR: 3 + 1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUCTL2 FOUCTP2	3	-	1	5 hours	30	70	100	200	4

Objectives:

1. To acquint the students about cell biology, tree breeding and genetic resource conservation in forestry.
2. To develop skill related to practical aspects of the role of biotechnological approaches, tissue culture, macro-propagation, transgenic technology in the field of forestry.
3. To aware the students about the importance of the subject in the field of clonal forestry

Theory

Basic genetics principles– Plant cell structure and function, cell reproduction (Mitosis and Meiosis); Structure of DNA and RNA; Structure of chromosome, chromosomal aberration; Mendal law of inheritance, deviation from Mendal law; Complementary gene, duplicate gene, pleiotropy, co-dominance, incomplete dominance, gene interaction; Heritability, Genetic advance, genetic gain,

combining ability, Hardy-Weinberg equilibrium, Tree Breeding- Variation in trees. Natural variation, Geographic variation. Selection and management, Plus tree selection, species and provenance selection, progeny testing, Quality seed production technology- seed orchard, seed production area, selection of seed tree, plus tree and elite tree.

Introduction to Forest tree improvement- Reproduction, Pollination, Genetic variable, Qualitative and Quantitative genetics, Plant tissue culture, Biotechnology, Genetic engineering, mutation, Plant breeding, breeding methods, selection, and its importance.

Practical

Preparation of slides for Mitosis/Meiosis. Testing viability and germination of pollen and seeds. Numerical analysis of population genetics questions, Plus tree selection, Variation analysis in a forest population, Numerical questions on quantitative genetics, Study of pollination system of some tree species. Pollen viability and germination tests. Visitation rate and foraging behaviour of Pollinators. Practice of cutting, grafting budding and air layering. Use of growth regulators in seed and vegetative propagation; selection and maintenance of mother trees, collection of scion; Micrografting.

Suggested Readings:

1. Datta, M., and Saini, G.C. (2009), Forest Tree Improvement & Seed Technology, International Book Distributor, Dehradun.
2. FAO. (1985) Forest Tree Improvement, FAO Publication, Rome, Italy.
3. Fins, L., Friedman, S.T. and Brotschol, J.V. (1992) Handbook of Quantitative Forest Genetics, Klumer Academy, Dordrach, London.
4. Khan I M (2014) Forest Biotechnology. Today and Tommorow publishers,New Delhi
5. Mandal, A.K. and Gibson, G.L. (eds) (1997). Forest Genetics and Tree Breeding. CBS Publisher& Distributor, New Delhi
6. White, T.M. and G.R. Hodges. (1989) Predicting breeding values with application in forest improvement. Kluwar Publishing, Netherlands.
7. Cell Biology, Cytology and Genetics- P.K. Gupta
8. Wright, J.W. (1976) Introduction to forest genetics. Academic Press, New York. 463 p.
9. Zobel, B.J. and J. Talbert. (1984) Applied forest tree improvement. John Wiley & Sons, New York.

Course Outcomes:

CO1: Students will be well equipped about the general principles of plant and tree breeding, and plant genetic resources.

CO2: Skill related to practical aspects of biotechnology such as tissue culture, macro-propagation and use of transgenic technology will be gained by students.

CO3: Students will also have the practical exposure of the field of plus tree selection, provenance trial.

CO4: Students will enhance about the commercial aspects of biotechnology in forestry and related subjects.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2	2	2	3	3	3	3	3
CO2	3	3	2	1	2	2	2	3	3	3	3	3
CO3	3	3	2	3	2	2	2	3	3	3	3	3
CO4	3	3	2	3	2	2	2	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-III: MINOR PAPER **(Minor-04)** **CR: 3+1**
Drawn From the University pool

PAPER-IV: MULTIDISCIPLINARY **(MTD-03)** **CR: 3**
Drawn From the University pool

PAPER-V: ABILITY ENHANCEMENT COURSE **(AEC-03)** **CR: 2**
Drawn From the University pool

PAPER-VI: SKILL ENHANCEMENT COURSE **(SEC-03)** **CR: 3**
Drawn From the University pool

SEMESTER – IV

PAPER-I: TREE SEED AND NURSERY TECHNOLOGY **(Major- 05)** **CR: 4+1**

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUDTL1 FOUDTP1	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To understand and identify the forest tree seeds and viability aspects.
2. To provide knowledge on seed developments, seed types and method of seed testing and seed treatment.
3. To equip learners about seed certification and seed trade for commercialization.
4. To develop seed professionals in forest seed handling and quality testing.

Theory

Seed formation in forest trees. Classification of forest tree seed, Seed structure, chemical composition, germination, seed viability and factors affecting seed viability, Seed dormancy and pre-treatment of breaking dormancy, determining optimal harvest maturity indices. Seed collection methods, seed processing, extraction, drawing, cleaning, grading, treating, bagging, levelling and storage. Storage of Orthodox, recalcitrant seeds and fumigation and seed treatment. Seed cryopreservation, quality testing, purity, viability, moisture, vigor and seed certification. Quality seed production technology- seed orchard, seed production area, selection of seed tree, plus tree and elite tree. Seed certification agencies.

Forest nursery, nursery operations, Use of growth regulators; mulching, hardening of plants in nurseries. Propagation methods, Mist chamber, greenhouses, glasshouses, poly-houses, nursery tools and implements. Uses of manures and bio fertilizers.

Practical

Identification of seed tree species, seed collection, seed treatment, seed maturity test, germination test, dormancy testing, seed vigor and storage techniques, visit to seed production areas and seed orchards. Nursery Record Management; Basics of Propagation; sexual and asexual methods; Nursery techniques. Hardening of plants in nurseries. Insect/pest/disease control in nursery. Study of nursery tools.

Suggested Readings:

1. Ram Prasad and A K Kandya (1995). Handling of Forestry seeds in India, Natraj Publication, Dehradun
2. P.K. Agrawal and M Dadlani (1987). Techniques in seed science and technology, South Asian Publishers, Delhi
3. R.L. Agrawal (1996). Seed Technology, Oxford and IBM Publishing Co., New Delhi
4. M.P. Nema, M P (1987). Principle of Seed Certification and Technology, Elite Publishers
5. Renuga Devi, J NV Manumani (2011). A handbook of seed testing, Agrivos publication

Course Outcomes:

CO1: Students will get the in-depth knowledge about seeds of forest tree and method to maintain viability.

CO2: Students will get knowledge about seed, seed developments, types of seed, seed viability, seed treatment, dormancy, seed testing etc.

CO3: Students development for seed certification and handling and trading.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2	2	2	3	3	3	3	3

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CO2	3	3	2	1	2	2	2	3	3	3	3	3
CO3	3	3	2	3	2	2	2	3	3	3	3	3

Weightage: **1-Sightly;2-Moderately;3-Strongly**

PAPER-II: FOREST MANAGEMENT (Major- 06) CR: 4+1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUDTL2 FOUDTP2	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To provide knowledge about forest management for sustainable growth.
2. To provide knowledge about growth and yield models, silviculture system in different land use patterns.
3. The students will be able to understand community and joint forest management practices.
4. To develop and evaluate management plans in forestry and its allied subject for students.

Theory

Definition and scope of forest management. Principles and Peculiarities of forest management. Objects and purpose of management. Forest management and administrative units, felling cycle, cutting section. Sustained yield; management and administrative units, Rotations, Normal forest, Estimation of growing stock and increment. CAI –MAI relationship, Yield regulation, Working Plan- definition, objects and necessity, preparation of working plan. Joint forest management: concept and methodology. Criteria and Indicator for sustainable forest management. Silvicultural systems. Clear felling, shelterwood, coppice. Selection system.

Practical

Visit to forest department to observe working procedures. Study of working plans of the forests. Learning of preparation of working plan for one of the area. Estimation of MAI and CAI, Fixation of rotation for species. Perform a survey of forest area & chalk out a plan for silviculture management. Drawing of silvicultural treatment map. Case study of JFM.

Suggested Readings:

1. Champman, G.W. and Allan, T.G. (1978) Establishment Techniques for Forest Plantation F.A.O Forestry Paper No.8. F.A.O Rome
2. David M. Smith. (1989) The Practice of silviculture. IBD Educational Pvt. Ltd. Dehradun, India.
3. J B Lal (2007). Forest Management: Classical Approach and Current Imperatives. Natraj publishers, Dehra Dun.
4. Jerram, M. R. K., (2005). A text Book on Forest Management, CBS Publishing.
5. Khanna, L. S. (1984) Principles and Practice of Silviculture, Khanna Bhandu, Dehra Dun. P. 476.

6. Negi, S. S., Forest Management in India.
7. Osmaston, F.C. Management of Forests, (1984) IBD Publication, Dehradun
8. Ram Prakash and L.S. Khanna (1991) Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun.
9. Ram Prakash. Forest management, (2006) IBD Publication, Dehradun

Course Outcomes:

CO1: Students will develop knowledge about recent advances in forest management.

CO2: Students will learn about estimation of forest tree volume, gender participation in forest management, community resources and joint forest management.

CO3: Students will develop how to develop and evaluate management plans in forestry.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2	1	2	3	3	3	3	3
CO2	3	3	2	1	2	1	2	3	3	3	3	3
CO3	3	3	2	3	2	1	2	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-III: FOREST ECOLOGY AND ECOSYSTEM ANALYSIS (Major- 07) CR: 3+1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUDTL3 FOUDTP3	3	-	1	5 hours	30	70	100	200	4

Objectives:

1. To develop knowledge about ecological aspects of forest resource and biodiversity conservation.
2. To develop skill on conducting biodiversity survey.
3. The student will be able to understand ecological principles and concepts including forest structure and function of ecosystem
4. To develop knowledge about biodiversity conservation (In-situ and ex-situ) approaches for high ecosystem service
5. To address the causes of land and forest degradation and deterioration and restorative technologies.
6. Development of ability to evaluate the site quality of different types of waste and degraded forest

Theory

Concept of ecology, community and population ecology, ecosystem structure and function, types of ecosystems, energy flow in ecosystem, food chain, food web, ecological pyramids, forest biodiversity and its conservation, diversity indices (alpha, beta, gamma), Forest productivity, biomass of trees, concept of succession, Nutrient cycling and dynamics in forest ecosystem, organic matter decomposition, nutrient conservation strategies in forest.

Concept of global change ecology, major global change issues (increasing atmospheric CO_2 concentration, land use change), Climate change, carbon credit, carbon trading, fluxes and transformations, major impacts of global ecological changes on forests. CBD, IPCC, UNFCC, COP, Kyoto Protocol, Paris agreement

Practical

Determine the community structure of a forest stand, Biodiversity assessment- Frequency, density, IVI, Shannon-Weiner index, Simpson index, litter accumulation/decomposition determination in forest stand. Calculation of carbon sequestration, biomass of tree species, Use of online tools for Biodiversity/Carbon assessment.

Suggested Readings:

1. E.P. Odum (1983). Basic Ecology. Saunders College Publishing, Holt Saunders, Japan.
2. Ashok Malik (2008) Dynamics of forest ecosystems. Today and Tomorrow publishers, New Delhi.
3. J.S. Singh, S. P. Singh., S. R. Gupta (2014). Ecology, Environmental Science and Conservation. S. Chand publication.
4. Krebs, C.J. (2016). Ecology, Pearson Education Inc.
5. J.W. Doran and A.J. Jones (1996). Methods of Assessing Soil Quality. Soil Science Society of America, Madison.
6. D.J. Greenland and I. Szabolcs (1994). Soil Resilience and Sustainable Land Use. CABI.
7. J. Sehgal J and I.P. Abrol (1994). Soil Degradation in India - Status and Impact. Oxford & IBH.
8. Perry, DA, Ores, R and Hart, S.C. (2008). Forest Ecosystems (2nd edition) The John Hopkins University press, Baltimore

Course Outcomes:

CO1: Students will develop in-depth knowledge about forest resource and biological diversity.

CO2: Students will learn the analytical measurement of floral and faunal diversity.

CO3: The student will be able to understand the different methods of biodiversity conservation method (In-situ and ex-situ) and management plan.

CO4: Student will enhance knowledge on assessing site quality, causes of forest degradation, and deterioration.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4

CO1	3	1	2	1	3		3	3	3	3	3	3
CO2	3	1	2	1	3		3	3	3	3	3	3
CO3	3	1	2	3	3		3	3	3	3	3	3
CO4	3	1	2	3	3		3	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-IV: MINOR PAPER (Minor-04) CR: 3 + 1

Drawn From the University pool

PAPER-V: ABILITY ENHANCEMENT COURSE (AEC-04) CR: 2

Drawn From the University pool

SEMESTER – V

PAPER-I: Application of RS & GIS in Forest and Watershed Management (Major- 08) CR: 4+1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUETL1 FOUETP1	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To give exposure to the students on Remote Sensing and GIS in Forest and watershed hydrology and their management for sustainable development.
2. To provide knowledge related to forest vegetation and the restoration of the riverine ecosystem through RS & GIS.
3. To enable students to develop expertise for the implementation of integrated forested watershed projects through satellite remote sensing.
4. To develop the skills of students by equipping practical exposure to forest and watershed planning, management, and conservation works.

Theory

Remote sensing – definition, concept and principles, EM Radiation and EM Spectrum, Interaction of EMR with atmosphere and earth's surface, Platforms, Sensors, Satellites, and their characteristics - geostationary and sun-synchronous, Concept of the resolution, Optical mechanical scanners, image interpretation techniques, Remote sensing data products, and their procurement, Introduction to GIS – definition, concept, components, Spatial data analysis, Geotagging, Role of RS and GIS in forestry, Vegetation indices, Forest cover mapping through RS and GIS, Remote Sensing application in forest cover change detection, Biodiversity studies using RS and GIS, Basic concept of water resources: hydrological cycle, Darcy's law, Issues in water resources development, management, and utilization, Types of aquifers, aquiclude, aquitard and aquifuge and location of

aquifers. Drainage mapping. Watershed management- introduction, philosophy and concept and role of remote sensing in watershed conservation, planning and management, Watershed characterization and mapping, Ground truth collection.

Practical:

Study of satellite images, and marking reference system, Visual interpretation of satellite images, Study of SOI topographic sheets, Base map preparation, Handling of GPS, data collection and integration of GPS data, drainage map preparation, LU/LC and forest vegetation map preparation, ground truthing of the data in the field.

Suggested Readings:

1. S. K. Datta (1985). Soil Conservation and Land Management. International Book Distributors, Dehradun
2. R. Suresh (2006). Soil and Water Conservation Engineering. R Standard Publishers Distributors, Delhi.
3. Rajvir Singh (2000). Watershed Planning and Management. Yash Publishing House, Bikaner.
4. B. Venkateswarlu, Mohammed Osman, M.V. Padmanabhan, K. Kareemulla, P.K. Mishra, G.R. Korwar and K.V. Rao (2013). Field Manual on Watershed Management. CRIDA, Hyderabad
5. G. Das (2008). Hydrology and Soil Conservation Engineering: Including Watershed Management. Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
6. V.V. Dhruva Narayana, G. Sastry and U.S. Patnaik (1997). Watershed Management. ICAR, New Delhi.
7. Tideman, E.M (1996). Watershed Management: Guidelines for Indian Conditions., Omega Scientific Publishers, New Delhi.

Course Outcomes:

CO1: Students will gain knowledge about regional, national and global watersheds and its management action plan, water and soil conservation efforts.

CO2: The technical knowledge related to the restoration of river and its sustainable management of resources.

CO3: Students will get expertise knowledge and skill related to the implementation of integrated watershed projects.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2	2	3	3	3	3	3	3
CO2	3	3	2	1	2	2	3	3	3	3	3	3
CO3	3	3	2	3	2	2	3	3	3	3	3	3

Weightage: **1-Sightly;2-Moderately;3-Strongly**

PAPER-II: WOOD SCIENCE AND TECHNOLOGY (Major- 09) CR: 4 + 1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUETL2 FOUETP2	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To acquaint with the physical and characteristics and strength properties of wood.
2. The course enables the students to deal with wood identification, degrading agents and wood moisture.
3. To gain knowledge about wood preservation techniques and technology for making engineered woods.
4. To gain knowledge about different seasoning method of wood.

Theory

Introduction to Wood, Wood formation, Wood properties- anatomical and physical features of wood. Electrical, thermal and acoustic properties of wood. Mechanical properties of wood; natural characteristics affecting mechanical properties of wood, Suitability of wood for various uses; Extractives in wood. Wood water relations, seasoning of Wood, Classification of timbers based on durability. Defects of timber- natural and seasoning defects, bio-deterioration of wood, wood preservation; Wood machining. Dimensional stabilization of wood. Engineered wood: Composite wood, Plywood, Particle board, Laminated wood, Block board, Fiber board manufacture and utility. Wood certification.

Practical

Wood physical and chemical propertins, Microscopic and macroscopic features of wood, Determination of moisture content and shrinkage of different wood species. Determination of wood density, bending properties of various wood species. Analysis of wood deterioration, treatment of wood with different preservatives. Procedures for field identification of timbers. Visit to Saw mill and wood workshops to know the machinery and equipments, storage, various sawn forms.

Suggested Readings:

1. Anonymous (1976). Indian forest utilization. Volume I and II ICFRE Publication, Dehradun.
2. T. Mehta (1981). A Handbook of Forest Utilization. Periodical Expert Book Agency, Delhi.
3. K.R. Rao and K.B.S. Juneja (1992). Field identification of 50 important timbers of India. ICFRE Publication, Dehradun.
4. L.C. Sharma (1977). Development of forests and forest based industries, Bisben Singh and Mahendra Pal Singh Publication, New Delhi

5. Terry Porter (2006). Wood Identification and Use. Guide Master Craftman publications.
6. S. Hill Callum (2006). Wood modification: Chemical thermal and other process. Today and Tomorrow publishers.

Course Outcomes:

CO1: Students will learn about detail physical characteristics and strength of wood.

CO2: The students will have practical knowledge about wood identification, wood degradation and protective measures for long term uses.

CO3: Students will learn about wood preservation techniques, seasoning methods and technology for making engineered woods.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	1	2	1	2	3	3	3	3	3
CO2	3	1	2	1	2	1	2	3	3	3	3	3
CO3	3	1	2	3	2	1	2	3	3	3	3	3
CO4	3	1	2	3	2	1	2	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-III: FOREST RESOURCE MANAGEMENT AND ECONOMICS (Major-10)

CR: 4+1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUETL3 FOUETP3	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To know the basic elements of forest economics for income generation.
2. To the students will be able to gather knowledge on basic economic principles.
3. To develop the concept of production forestry and demand, supply pattern of forest products.
4. To provide wider vision related to price and income elasticity in forestry.

Theory

Basic concept of economics, Nature and scope of economics and its relationship with other sciences. Types of goods, Concept and types of demand, law of demand, measures of demand elasticity, Concept and types of supply, law of supply, measures of supply elasticity, Types and theory of utility, Diminishing law of utility, equi-marginal utility and Hicks-Allen approach for determining consumer equilibrium, Concept of revenue, Factors of production, their definition and characteristics, Law of diminishing marginal returns. Application of microeconomics in solving forest resource problems. Emphasis on forest products demand and supply analysis. Forest land valuation. Quantification and valuation of NTFPs. Market – its classification and price determination under different market situations. Market of various forest products marketing of NTFPs, MSP of Forest produces in India and Chhattisgarh. E-marketing. Marginal productivity theory, risk talking and uncertainty bearing theories of profit. National income and its concepts. Concepts and types of inflation. Finance carbon forestry, Carbon Credits.

Practical

Estimation of demand elasticity with respect to price and income. Estimation of Supply elasticity with respect to price and income. Utility measurement- total utility, marginal utility and average utility. Revenue measurement- total revenue, marginal revenue and average revenue. Market classification- visits to different markets of Forest based products. Price determination under different market conditions

Suggested Readings:

1. Edwin S. Mills (1975) Economic Analysis of Environmental Problems. New York: Columbia University Press
2. Fisher, A.C (1979) Resource and Environmental Economics. New York: John Wiley & Sons.
3. Nautiyal, J. C., (2011), Forest Economics, Principle and Applications, Natraj Publishers, Dehradun. New Delhi.
4. Orris C. Herfindahl (1969) Natural Resource Information for Economic Development. Baltimore: The Johns Hopkins University Press
5. Sharma, L.C., Forest economics planning & management.
6. Subba S Reddy (2012) Agricultural Economics. Oxford and IBH publishers.
7. Girish B Shahapurmath, S. S. Inamati. (2020), Marketing and Trade of Forest Produce, ISBN: 9789388020671, Satish Serial Publishing House

Course Outcomes:

CO1: Students will get knowledge about the implementation of economics in forestry and its allied subjects.

CO2: The students will be able to know about the demand and supply of forest based industries and its diversification.

CO3: The subject knowledge will help the students for further career development.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	3	3	3	3	3	3	3	3
CO2	3	3	3	1	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3

Weightage: **1-Sightly;2-Moderately;3-Strongly**

PAPER-IV: MINOR PAPER **(Minor- 05)** **CR: 3 +1**

Drawn From the University pool

PAPER-V: INTERNSHIP **(INT- 01)** **CR: 2**

SEMESTER – VI

PAPER-I: FOREST PROTECTION **(Major- 11)** **CR:4+1**

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUFTL1 FOUFTP1	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To provide knowledge about forest protection, disease and insect pest of forest nursery, plantation and natural forests.
2. To guide students on integrated approaches of pest control and plant health.
3. To equip students on modern systems of forest protection and constituents of chemicals

Theory

Concept of forest protection, forest Pathology, Disease & Koch's postulates. Disease cycle, Biodegradation of wood; Heart rots; important fungal diseases of seedlings in forest nursery, forest diebacks, Role of mycorrhiza in tree health. Factors affecting forest health; grazing & browsing, adverse climatic factors, weeds and other invasive species. Forest Entomology: Insect-plant relationship, population dynamics of forest insects, Major diseases of forest trees- Teak, Sal, Sissoo,

Bamboo etc., Insect classification groups, Insect pests of Commercially important tree species. Principles and Methods of Pest Management; Chemical control, Biological control of insect pests and diseases of forest trees. Integrated Pest Management. Forest fire (History, types, main causes, prevention and control), Evaluation of losses due to forest fire, Forest fire monitoring system.

PRACTICAL

Identification of diseases of forest nursery seedlings, Collection, identification and preservation of disease specimens of forest trees, Microscopic observations of pathogens, Culturing of major pathogens, Collection and preservation of forest insects, plant protection equipments, Preparation of herbarium of forest weeds, Laboratory tests for estimating decay resistance in wood, Extraction of spores of arbuscular mycorrhizal fungi from soil, Isolation and identification of fungal flora in decayed wood. Use of fungicides and pesticides for disease control

Suggested Readings:

1. Bakshi, B.K. (1976) Forest Pathology. Principles and Practices in Forestry. Controller of Publications, New Delhi.
2. Beeson, C.F.C. (1941) Forest Insects of India, The Ecology and Control of the diseases. International book distributers, Dehra Dun.
3. Brues, T.C., A.L. Melander and E.M. Carpenta, (1954) Classification of Insects, Cambridge Man, USA.
4. Gupta, V.K. and N.K. Sharma. (1988). Tree Protection. Indian Society of Tree Scientists, Solan.
5. John Saw Boyce, (2015), Forest pathology, Agrihorti Press.
6. Khanna, L.S. (1984) Forest Protection, Khanna Bandhu, Dehra Dun.
7. Paul D Menan (2003) Tree and disease concept. Prentice hall Inc.
8. Satha T V (2009) A textbook of forest entomology. Today and tomorrow publishers.
9. Sathe, T.V., (2016), Forest Entomology, Daya Publishing House, New Delhi.

Course Outcomes:

CO1: Students will learn about forest tree diseases, insect and pest.

CO2: Students will be able to identify pest and disease in nursery, plantation and forest and suggest control measures.

CO3: Students will enable to recommend different chemicals and measures for disease control and forest species growth and development.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	-	2	3	3	3	3	3
CO2	3	3	3	3	2	-	2	3	3	3	3	3

CO3	3	3	3	3	2	-	2	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-II: AGROFORESTRY AND TREE OUTSIDE FOREST (Major- 12) CR: 4 + 1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUFTL2 FOUFTP2	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To provide knowledge about status of agroforestry and tree outside forests.
2. To develop student's competencies on tree based farming, and carbon monetization to farmers.
3. To understand the potential areas for outside forest plantations, commercial forestry and tree crop interaction.
4. To develop understanding on carbon sequestration potential of traditional and modern agroforestry systems.

Theory

Definition and concepts of Agroforestry; Classification of agroforestry systems, Benefits and constrains of agroforestry, Agroforestry practices and systems in different agroclimatic zones of India, Shifting cultivation, Taungya, Homegarden, Alley cropping, Plantation crop combinations, Traditional/Commercial agroforestry systems, Characteristics of agroforestry trees, MTPs, Tree-Crop Interactions, Concept of allelopathy and its impact on agroforestry. Tree architecture and Canopy management. Biomass production; Carbon sequestration potential in agroforestry. Criteria of an ideal agroforestry design, productivity, sustainability and adoptability; Diagnosis and Design (D&D) methodology. Economic analysis of agroforestry system, Agroforestry research and development; Goals, objectives and strategies, Tree outside forests, social forestry, farm forestry, urban forestry, Wood lot, ley-ras, industrial plantations.

Practical

Visit to agroforestry sites to study different Tree-crop combinations, Structural analysis and plant composition in different agroforestry systems, Tree characterization for agroforestry, Economic evaluation of agroforestry systems, Field exercise on plot demonstration showing root distribution of different plants. Identification, characterization and calculation of manures and fertilizers. Canopy measurement and light interception, Estimation of Biomass and carbon sequestration.

Suggested Readings:

1. Bane, Lester, (2016). Agroforestry, Syrawood Publishing House, New York.

2. Chundawat D S and Gautam S K (2010) Textbook of agroforestry. Oxford and IBH publishing co pvt. Ltd.
3. Dwivedi, A.P. (2012), Agroforestry, Principle and Practice, Oxford & IBH Publishing Company, New Delhi.
4. Khosla, P.K. and Khurana, D.K. (1987) Agroforestry for rural needs. Vol. 1 and II, ISTS, Solan, H.P.
5. Nair, P.K.R. (1993) An introduction to agroforestry. Kluwer Academic Publishers. 499 p.
6. Ong, C.K. and Huxley, P.K. (1996) Tree crop interactions – A physiological approach. ICRAF, Kenya. 386 p.
7. Pathak, P.S and Ram Newaj, (2012), Agroforestry, Potentials and Opportunities, Agrobios (India).
8. Ramakrishnan, P.S. (1992) Shifting agriculture and sustainable development. Man and biosphere series. The Parthenon Publishing Group. 424 p.
9. Sen Sarma, P.K. and Jha, L.K. (1993) Agroforestry. Indian Perspectives. Ashish Publishers, Delhi.
10. Chandra KK and Rajesh Kumar (2022) Forestry Practicals. A complete practical solutions for students. Scientific Publishers, Jodhpur, India.

Course Outcomes:

CO1: Students will get information on current scenario of agroforestry and tree outside forests.

CO2: Student's will develop competencies on tree based farming and managements.

CO3: Students will be able to identify the potential areas for plantations and carbon sequestration calculation.

CO4: Students will be able to estimate the demand and requirement related to timer and non-wood forests products for its industrial application.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1	3	1	3	2	3	3	3	3	3	3
CO2	3	1	3	1	3	2	3	3	3	3	3	3
CO3	3	1	3	3	3	2	3	3	3	3	3	3
CO4	3	1	3	3	3	2	3	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-III: FOREST PRODUCTS AND FOREST BASED INDUSTRIES (Major-13)

CR: 4 + 1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits

FOUFTL3 FOUFTP3	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. Students understanding and knowledge on various non-wood forest products and its value addition
2. To give the knowledge about forest and tribal relationship, indigenous knowledge system.
3. To analyze different forest products, value addition and their impact on tribal economy and livelihood.
4. The course will equip the student's employability to wood and forest-based industries.

Theory

Major and Minor forest products of India and Chhattisgarh; NTFP products- Dye, Tannins, Gums, Resin, essential oils, lac, shellac, katch and kathe, medicinal and aromatic plants, bamboo and Cane, tassar, silk, honey, tendu leaves, mahua, triphala etc., Methods of survey, classification, collection, processing and utilization of NTFPs. Value addition. Trade and marketing of NTFP; Policy and legal issues: NMPB, MPCA, Bamboo mission.

Status of wood production in India, Logging and extraction techniques, transportation, storage and sale. Major wood and forest- based industries, contribution to Indian economy, Paper and Pulp, Plywood, Match box, Sports goods etc.

Practical

NTFP collection and documentation, Visit to nearby wood-based industries, Tendu leaf plucking, bundling and drying, Extraction and distillation of essential oils, Identification of medicinal and aromatic plants, Identification of various plants and animals based NTFPs. NTFP and livelihood analysis in nearby villages. Silk production, lac production etc., Different types of engineered wood.

Suggested Readings:

1. Ashok Ranjan Basu& S. Nijhavan (1985) Tribal Development Administration in India. Mittal publications.
2. C.M. Cottan (1996) Ethno botany: Principles &Applications. Jhon Wiley and sons Ltd.
3. Dwivedi, A.P. (1993) Forests - the non-wood resources. International Book Distributors, Dehradun 352 p.
4. Mehta T (2012) A handbook of forest utilization. Today and Tomorrow publishers.
5. Tsank P (2010) Forest product and their utilization. Today and Tomorrow publishers.
6. V.P. Agrawal (2002) Forest in India. Oxford and IBH publishers.
7. Vinod M. Mhaiske, Vinayak K Patila and Satish S Narkhede (2016). Forest Tribology and Anthropology. Scientific Publishers, Delhi.

Course Outcomes:

CO1: Students will learn about non-wood forest products and their utilization aspects.

CO2: Students will know that how tribal and local community utilizes the forest resources using indigenous knowledge.

CO3: Students will develop in-depth knowledge about major forest products and tribal economy and livelihood.

CO4: The students will improve the employability to industries.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	2	1	2	3	3	3	3	3
CO2	3	2	2	1	2	1	2	3	3	3	3	3
CO3	3	2	2	3	2	1	2	3	3	3	3	3
CO4	3	2	2	3	2	1	2	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER -V: MINOR PAPER **(Minor- 06)** **CR: 3 + 1**

Drawn From the University pool

2/7/2023

SEMESTER – VII

PAPER-I: WILDLIFE MANAGEMENT AND ECO DEVELOPMENT (Major-14)

CR: 4+1

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUGTL1 FOUGTP1	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To give the understanding about faunal diversity and strategies of conservation of wildlife.
2. To give the understanding basic knowledge of wildlife classification, identification, wildlife census methods.
3. Management and conservation of wildlife resource of the country as a holistic approach.
4. To give the understanding about man and wildlife conflict

Theory

Biodiversity and Wildlife. Principles of wildlife management, animal-habitat studies, conservation biology, management of animal communities, habitat management. Conservation ethics- Definition, values, sign and symptoms. Wildlife Management Plan. Wildlife behavior studies, Human-Wildlife conflict, Wildlife census; Captive wildlife; Captive breeding for conservation. Central Zoo Authority of India. Wildlife (Protection) Act, 1972; Conservation strategy and life support system, protected area network, agencies for conservation of Wildlife, human dimension, wildlife in managed forests; Wildlife corridor. Eco development in support of conservation & protected area management, animal habitat studies, Scope of eco development, thrust areas in eco development, planning and implementation; Eco development: Macro and micro planning, Case studies

Practical

Identification of Birds and Butterflies in the campus, Field Visits and Field Exercises, Pug mark identification, Wildlife habitat study, Wildlife census, Wildlife Rescue techniques, Case studies related to man-animal conflict, habitat development and biodiversity conservation, Visit to biosphere reserve, sanctuaries, national parks, Zoo, safari, etc.

Suggested Readings:

1. Balakrishnan, M., (2016), Wildlife Ecology and Conservation, Scientific Publication.
2. Dwivedi A P (2009). Managing wildlife of India. International Book Distributors, Dehradun, India.
3. Karanth K. Ullas (2017), Wildlife Population, Nataraj Publications.
4. Rajesh Gopal (1992). Fundamentals of wildlife management. Justice Home, Allahabad, India.

5. Robert, A.W. (1979). The ecology and evolution of animal behavior. Good Year Pub. Co. California, U.S.A.
6. Robert, G.H. (1978). Wildlife management. W.H. Freeman and Co., San Francisco, U.S.A.
7. Singh S K (2009). Textbook of wildlife management. Today and Tomorrow publishers.

Course Outcomes:

CO1: Student will gain knowledge of faunal diversity of different bio-geographical zones.

CO2: Student will able to identify wildlife (mammals, reptiles, amphibian, avian and insects) in their natural habitat.

CO3: Students will learn about management and conservation of protective and natural habitat.

CO4: Students will learn about man and wildlife conflict and also help in solving the related issues.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	2	2	3	3	3	3	3	3
CO2	3	3	3	1	2	2	3	3	3	3	3	3
CO3	3	2	2	3	2	2	3	3	3	3	3	3
CO4	3	2	2	3	2	2	3	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER- II: WORLD FORESTRY, URBAN FORESTRY AND COMMUNITY FORESTRY

(Major- 15) **CR: 4+1**

Sub Code	L	T	P	Duration	IA	ESE	ESE(P)	Total	Credits
FOUGTL2 FOUGTP2	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To understand the world forest distribution and vegetation structure.
2. Planning, establishment, and management of urban forests for wellbeing of urban environment.
3. To identify forest species for suitable place of planting, gardening, avenue plantations for green and smart city concepts.
4. To develop important strategies related urban landscaping and pollution free city.

Theory

World forestry and their geographical classification. Forest resources and Forestry practices in different regions of the world. Recent trends in Forestry development in the world. International and National Forestry Organizations. Urban forestry- concept, history, component and functions of Urban Forestry, Tree Hazard Assessment in smart city Street, roads and parks tree inventories and Valuation, Urban Wildland Interface, Species selection for urban forestry, planning and implementation. Terrace gardening. Miyawaki plantation. Community forestry-concept, history, component and functions, linkage between community forestry and natural resources management, forest societies, interactions between forests and people, importance of forests in traditional farming systems, people's movements in forest conservation, community management and sustainable livelihood strategies, ecotourism and community development.

Practical

Plot the different biomes of the world map. Study about the different Bio-geographic regions of world & plot them on a map. Study and distribution of forest resources of South America, Africa, India and South East Asia. Plot the different hot spots of India on a map. Study of different hot spots of the world. Identification of various types of forest tree species found in urban environment. Tree hazards assessment through different methods. Species selection for urban forestry. Study the role of community in ecotourism. Study of sacred groves. Ecosystem services of Urban/community forestry.

Suggested Readings:

1. Malcom Fisher (1999). Urban forestry: planning and management. Syrawood publication house
2. V.K. Prabhakar (2000). Forestry and forest resources. Anmol Publication, New Delhi.
3. S S Negi (1989). Urban and recreational forestry. International book distributors, Dehradun.
4. S S Negi (2003). Manual of forestry. Bishensingh, Mahendra Pal Singh, Dehradun.
5. Vyas GPD. 1999. Community Forestry, Agrobios

Course Outcomes:

CO1: Students will learn about the forest/ green belt establishment and management of urban areas.

CO2: Students enable to identify appropriate tree species for urban greening and urban forestry.

CO3: Students will be equipped to serve as urban landscaping and urban planner.

CO4: Students will get practical exposure on developing green belt, parks and oxyzones for urban management.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	1	2	2	2	3	3	3	3	3
CO2	3	1	2	1	2	2	2	3	3	3	3	3

CO3	3	1	2	3	2	2	2	3	3	3	3	3
CO4	3	1	2	3	2	2	2	3	3	3	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-III: FOREST POLICIES, ACTS AND LEGISLATION (MAJOR-16) CR: 4+1

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
FOUGTL3 FOUGTP3	4	-	1	6 hours	30	70	200	5

Objectives:

1. Develop awareness about different forest policies and environmental Acts.
2. To increase students understanding on offences and penalties for forest and wildlife crimes and authorities for appeal.
3. To provide information related to different International Conventions and acts.

Theory

Forest policy – Relevance and scope; National Forest Policy – 1894, 1952 and 1988; General principles of criminal law; Indian Panel Code, criminal procedure code; Indian evidence act applied to forestry matters. Forest laws; Indian Forest Act –1927, Forest Conservation Act 1980, Wildlife Protection Act 1972, Environmental protection Act 1986; Biodiversity Act, 2002, Schedules tribes (Recognition of forest rights), Act, 2007. Intellectual Property Rights; Important case studies and landmark judgments. International conventions of forestry issue. eg. Role of international treaties like CITES, IUCN, RAMSAR, CBD etc.

Practical- Visit to Forest Department and study about crime against Timber and Wildlife. Case study related to wildlife crime and Forest.

Suggested Readings:

1. W. Fernandes and Kulkarni (1986). Towards a new Forest Policy. Natraj Publishers, Dehra Dun.
2. National Forest Policy (1988). Government of India Publication, Delhi.
3. Indian Forest Acts with short Notes (1975). Allahabad Law Agency, Allahabad.
4. E. Podder and Erai (2011). Forest law and policy in India. Today and Tomorrow publishers.

5. L.S. Khanna (2001). Wildlife (Protection) Act 1972 as amended upto date with commentary, Khanna Bandu, Dehra Dun.

6. S.S. Negi (1985). Forest Law. Natraj Publication, Dehra Dun.

Course Outcome

CO1: Student will understand about the forest law and policies.

CO2: Student may contribute aware local people on forest rights and forest crimes.

CO3: Graduates will acquire knowledge on International Conventions related to Forestry and Environment.

CO4: Student enable to join wildlife and forest NGOs for helping wildlife crimes.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3	2	3	3	3	3	2	3	3
CO2	3	1	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	2	3	3	3	3	2	3	2
CO4	2	3	2	3	2	3	3	2	3	2	3	2

Weightage:1-Sightly;2-Moderately;3-Strongly

PAPER-IV: MINOR (Minor- 07) CR 3+1

Drawn From the University pool

PAPER-V: SEMINAR (SEM- 01) **CR: 1**

Sub Code	L	T	P	Duration	IA	ESE (P)	Total	Credits
	-	1	-	2 hours	-	100	100	1

Objective

1. Seminar will develop confidence and communication skills in to the students

Contents:

Student must present and participate in class seminar which will be conducted in the department every week. Based on the student performance in the seminar, the score/credit will be evaluated.

Course outcomes

CO1: Student will develop their personality and skills in various aspects.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	3	2	3	3	3	3	2	3	3

Weightage:1-Sightly;2-Moderately;3-Strongly

SEMESTER – VIII

PAPER I: BIOSTATISTICS AND RESEARCH METHODOLOGY (Major- 17)

CR: 4 + 1

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUHTL1 FOUHTP1	4	-	1	6 hours	30	70	100	200	5

Objectives:

1. To provide knowledge about fundamentals of biostatistics and its use in forestry.
2. Make students able to understand the data analysis, data representation and tabulation.
3. To develop the concept for testing hypothesis signification in practical.
4. To understand relationship between two quantitative variables related to the forest.

Theory

Definition and application of statistics, types and source of data, classification and tabulation of data, frequency distribution, graphical representation of data, (Bar diagram, pie chart, histogram, frequency polygon) measures of central tendency (mean, median, mode) measures of Dispersion (range, standard deviation, Mean deviation, Quartile deviation, variance, coefficient of variation), Probability, Test of signification: basic concepts, (Z- Test, X^2-Test, t-Test, F-test,), Sampling methods. Hypothesis testing and significance; Correlation; Linear models; Correlation coefficients; Regressions and multiple regressions. One-way ANOVA and two ways ANOVA. Experimental design: CRD, RBD, LSD, split plot designing and strip plot.

Practical

Handling computer-based Histogram, frequency polygon, Bar chart, pie Chart. Measures of central tendency: Mean median and mode for raw and grouped data. Construction of frequency distribution table and its graphical representation. Measures of dispersion: Range, mean deviation, Quartile deviations and standard deviation for raw and grouped data. Paired 't' test, Chi-square test for contingency tables and theoretical ratios Correlation and linear regression. Use of statistical software.

21/7/2023

Suggested Readings:

1. Arora P N (2003) Biostatistics. Himalayan publishers.
2. Arora, P.N. and P.K. Malhan (2016), Biostatistics, Himalaya Publishing House.
3. K.Balaji, A.V.S. Raghavaiah, K.N. Jayaveera (2012), Biostatistics, I.K. International Publishing House Pvt. Ltd. New Delhi.
4. Kenneth N. Berk (1998). Introductory Statistics.www.amazon.com
5. Marcello Pagano and Kimberlee Gauvreau (2008) Principles of Biostatistics. Jhon and Wiley Sons Ltd.

Course Outcomes

CO1: Students enable to exploit biostatistics in forestry and allied subjects.

CO2: Students friendly worksheet using excel sheet for analysis and data interpretation using computer based software.

CO3: Student will be efficient in data handling and graphic, and representation.

CO4: Subject will help in their professional development and career building.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

PAPER II: FOREST BUSINESS AND ENTREPRENEURSHIP DEVELOPMENT

(Major- 18) **CR:4 +1**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUHTL2 FOUHTP2	4	-	1	6 hours	30	70	100	200	5

Objectives

1. To provide entrepreneurship in forestry sector and improve their communication skill.
2. To encourage students to establish industries and start up related to forest products.

Theory

Concept of Forest Business, Forest business includes all activities from production to distribution of forest goods and services, Forest based industries in the world and India, production and distribution of goods and

services facilitates, Indian rural industries, export and import policies relevant to Forestry sector. Venture capital. Contract farming and joint ventures, public private partnership. Basics of Entrepreneurship Development, Concept of entrepreneurship, entrepreneurial and managerial characteristics managing an enterprise, motivation and entrepreneurship development. Entrepreneurship development programme, process and stages with its challenges and solution, SWOT analysis. Government schemes and incentives for promotion of entrepreneurship. Small-Scale Entrepreneurship (SME) among Marginalised Groups in India Social responsibility of business. Assessing overall business environment in Indian economy. Overview of Indian social, political and economic systems and their implication for decision making by individual entrepreneur. Globalization and emerging business / entrepreneurial environment

Practical

Visit to local forest-based industries nearby city, Methods collection and processing of NTFP in Chhattisgarh, Analysis of import and export methods of forest-based products in Chhattisgarh and India. SWOT analysis of Entrepreneurship Development, Analysis of SME programme for the entrepreneur skill and development, Forest or wood-based industries cost benefit analysis

Suggested Readings:

1. Irish B Shahapurmath, S. S. Inamati. (2020), Forest Business Management, ISBN: 9789388020619, Satish Serial Publishing House
2. A.S. Sandhu (2004) A Text Book of Agricultural Communication. Kalyani publications.
3. Bibhuti Bhusan Mohanty (1962) A Handbook of Audio Visula Aids. Kitabmehal Pvt. Ltd Allahabad.
4. G.L. Ray (2011) Extension Communication and Management. Kalyani publications.
5. O.P. Dahama& O.P. Bhatnagar (1987) Education & Communication for Development. Oxford University Press, New Delhi.

Course Outcomes

CO1: Student exposure to different entrepreneurship related to forestry and allied sectors.

CO2: Student promotions towards establishing start-up in forestry field.

CO3: Student will be able to analyze marketing pattern with suitable application for forest products.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3	2	3	3	3	3	2	3	3
CO2	3	1	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	2	3	3	3	3	2	2	3

PAPER III: MINOR PAPER (Minor- 08) CR: 3+1

Drawn From the University pool

PAPER IV: MINOR PAPER (Minor- 09) CR: 3+1

Drawn From the University pool

PAPER V: SEMINAR (SEM-02) CR: 2

Sub Code	L	T	P	Duration	IA	ESE (P)	Total	Credits
	-	2	-	2 hours	-	100	100	2

Objective

1. Seminar will develop confidence and communication skills in to the students

Contents:

Student must present and participate in class seminar which will be conducted in the department every week. Based on the student performance in the seminar, the score/credit will be evaluated.

Course outcomes

CO1: Student will develop their personality and skills in various aspects.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	3	2	3	3	3	3	2	3	3

Weightage:1-Slightly;2-Moderately;3-Strongly

PAPER VI: RESEARCH PROJECT/DISSERTATION CR: 12

Sub Code	L	T	P	Duration	IA	ESE (P)	Total	Credits
FOUHDD1	-	-	12	12 hours	-	100	100	12

Objective

1. To provide an opportunity to unearth new information related to specific topics of forestry and motivate students to pursue further research.

Contents:

Student must conduct a Research project based on some topics related to forestry which will be submitted as a Dissertation. The Dissertation will be evaluated by the external examiner based on power point presentation, Dissertation report and subject knowledge.

Course outcomes

CO1: Students will have the skill to carry out a minor research work and develop scientific writing skills.

CO2: Students will be capable to perform data analysis by using various statistical tools.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	3	3	3	3	3	2	2
CO2	3	3	3	3	2	3	3	3	3	3	2	2

Weightage:1-Sightly;2-Moderately;3-Strongly

MINOR COURSES

Minor 1- INTRODUCTION TO WILDLIFE **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUAML1 FOUAMP1	3	-	1	5 hours	30	70	100	200	4

Course Objectives:

1. Understand the importance of wildlife and their conservation.
2. Identify and describe key wildlife species and their habitats.
3. Analyze the ecological interactions between wildlife and their environment.
4. Evaluate conservation challenges and strategies for wildlife protection.
5. Demonstrate an awareness of ethical considerations in wildlife management.

Theory

Definition, scope and importance of wildlife of India, justification of wildlife conservation, zoogeographic regions and biomes of the world, biogeographic classification of India, wildlife ecology (basic ecological concept: food chain food web, ecological pyramid etc.), status and distribution of important wildlife species of India (rare, endangered and threatened species of mammals, birds, reptiles etc.), population dynamics and factors affecting wildlife population, human- wildlife conflict, threats and conservation of wildlife (In-situ and Ex-situ conservation), agencies involved in wildlife conservation (BNHS, WWF, Indian Board for Wildlife, CITIES, Wildlife Crime control Bureau of India etc.)

Practical

Visit to protected area/zoological park etc. and observe the morphological, behavioral feeding and other activities of mammals, reptiles, Aves etc. Study about the different wildlife survey methods. Study about the camera trapping methods. Demarcation of major hotspots of the world and India on map. Study about the protected area of India and their major faunal diversity. Systemic study of common animal species, study of campus fauna, rapid assessment of terrestrial fauna in nearby areas of the campus and demonstration/on-site discussion.

Suggested readings:

1. Dwivedi A P (2009). Managing wildlife of India. International Book Distributors, Dehradun, India.
2. Singh S K (2009) Textbook of wildlife management. Today and tomorrow publishers.
3. Saha, Goutam & Mazumdar, Subhendu. (2017). Wildlife Biology: An Indian Perspective.
4. Grewal, B. Sood, T. & Mathur, M. (2022). A Photographic Guide to the Wildlife of India. John Beaufoy Publishing.
5. Rajesh Gopal (2011), Fundamentals of wildlife Management, Natraj Publishers.

Course Outcomes:

CO1. Students will be aware of the importance of wildlife and their conservation needs.
CO2. Students will be able to analyze the ecological interactions between wildlife and their environment.
CO3. Students will know about the various organizations and agency involved in Wildlife conservations.

Minor 2- PLANTATION FORESTRY

(Credit- 3+1)

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUBML1 FOUBMP1	3	-	1	5 hours	30	70	100	200	4

Course Objectives:

1. To know about the scope of plantation in mitigating climate change effects.
2. To identify and study about the tree species used for plantations for rehabilitating degraded lands.
3. To study the management operations involved in plantation

Theory

Definition, scope and importance. Plantation forests - planting plan, plantation records, maps. Plantation establishment- legal title of land, survey, site selection. Site preparation - purpose and methods. Planting layout, time of planting, planting pattern, spacing, gap filling, planting methods, direct seedling. Choice of species on ecological aspects - afforestation of dry land, wet land, other adverse sites. Enrichment planting, nurse and cover crops. Intercultural operations. Plantation maintenance - weed control, climber cutting, staking, singling and pruning. Thinning - definition, objectives. Effects of thinning - physiological and mensurational. Effect of methods of thinning on stand development. Energy plantation. Climate change adaptation and mitigation through plantation forestry.

Practical

Study of tools, materials and operations for establishment of plantations, site selection and site preparation. Exercises on planting and tending. Exercises on protection of plantations. Exercises on plantation layout. Collection of data for survival and growth performance. Use of fertilizers, weedicides for plantation management. Application of Bio-fertilizers and soil amendments in different species.

Suggested Readings

1. Plantation Forestry in India by LUNA, R.K. (International Book Distributors, 2008)
2. Plantation Forestry in Tropics (3rd edition) by Julian Evans & John Turnbull (OUP Oxford, 2004)

3. Textbook of Plantation Forestry by A. Balasubramanian, C.N. Hari Prasath, S. Radhakrishnan (Jain Brothers, 2022)
4. Plantation and Protected Areas In Sustainable Forestry by William C. Price, Naureen Rana, V. Alaric Sample (Food Products Press U.S, 2006)
5. Nursery and Plantation Practices In Forestry (1st Edition) by Vinod Kumar (Scientific Publisher, 2011)
6. Practice Manual on Plantation Forestry by Pankaj Panwar And S. D. Bhradwaj (Scientific Publisher Journals Department, 2006)

Course Outcomes:

CO1. Students will learn about the scope of plantation in mitigating climate change.

CO2. Students will be able to identify and know about the tree species used for plantations for rehabilitating degraded lands.

CO3. Students will know the cultural operations and management operations involved in plantation activities.

Minor 3 - EARTH CARE POLICY (Credit- 3+1)

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUCML1 FOUCMP1	3	-	1	5 hours	30	70	100	200	4

Course objectives:

1. Creating the awareness about environmental problems.
2. Imparting basic knowledge about the international environment conservation policies.
3. Developing an attitude of concern for the environment.
4. Motivating public to participate in environment protection and environment improvement.

Theory

Earth care policy, Concept and need, Historical background of various International and national practice for environmental conservation. International agreements and policies for earth care, Ramsar Convention, stock herne convention, IPCC, Kyoto protocol, COPs, Paris Summit, CITES, CBD, Bonn convention, Montreal Protocol. United Nations Framework Convention on Climate Change, UNCCD, UN-REDD. Conservation policies of The Ministry of Environment, Forest and Climate change govt. of India, NAPCC, Convention on Biological Diversity (CBD), National Biodiversity Action Plan (NBAP), Nagar Van Udyan Scheme, Swachh Bharat Abhiyan, Project Tiger, the National Wetland Conservation Programme (NWCP), Green Skill Development Programme, National River Conservation Programme, Green India Mission, and National Afforestation Programme, National Coastal Management Programme, National Mission on Himalayan Studies under Climate Change Program. Acts passed by the Indian government: The Wildlife (Protection) Act, 1972, The Forest Conservation Act, 1980, The Water (Prevention and Control of Pollution)

Act, The Air (Prevention and Control of Pollution) Act 1982 Environment Protection Act, 1986.Functions of the Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB).

Practical

Prepare a flashboard on recent updation of earth care policy. Preparation of chart, poster, model and creative art to sensitize different issues related to environment. Case studies of various pollutions (air, water, soil, noise). Carry out Swachh Bharat Abhiyan in University campus/nearby areas.

Suggested Readings

1. Environmental law and policy in India: cases and materials: Oxford university press
2. Indian environmental law: The Orient Blackswan
3. Enviroomentalism (PB): A Global History: Penguin
4. Climate solution: Hachette India
5. Climate and Society: Transforming the Future: Polity
6. Natural Resources: Conservation Strategies, Globalization and Politics and Sustainable Uses: Nova Science publisher

Course Outcomes:

CO1. Students will be aware of various environmental problems and their control measures.
CO2. Students will have the knowledge about the national and international environmental conservation policies and acts to safeguard the environment.
CO3. Students will be able to motivate public at larger scale to participate in environment protection strategies and actions.

Minor 4 - VALUE ADDITION OF NTFP **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUDML1 FOUDMP1	3	-	1	5 hours	30	70	100	200	4

Course objectives:

1. To make students aware of the importance and uses of Non timber forest products.
2. To impart knowledge for collection, processing and value addition of some major NTFPs.
3. To motivate students about entrepreneurship and livelihood generation through NTFPs.

Theory

Overview of NTFPs- Definition, Economically important NTFPs of Chhattisgarh (*Sal, Mahua, Tendu, Chir, Tamarind, Amla, Harra, Behada, Jamun*, Mushrooms, Honey, Lac, etc). Concept of Value Addition in NTFP, Importance in NTFP, Value addition in the context of market demands and consumer preferences. Value Addition Techniques- Processing methods (drying, grinding, distillation, extraction, etc), Product development and diversification, Quality Control and Assurance- Standards and certifications for quality assurance, Processing and Value Addition of Specific NTFPs- Medicinal and Aromatic Plants- Processing and value addition techniques for medicinal plants, Aromatherapy and essential oil extraction. Edible NTFPs- Processing methods for nuts, fruits, and other edible forest products, Value addition in food products. Packaging and Labelling- Sustainable packaging options, Designing attractive and informative labels, Market Analysis and Strategies- Market research and identifying target markets, developing effective

marketing strategies for NTFP products. Entrepreneurship and Business Planning of NTFP based enterprises

Practical

Field Visits and Resource Assessment- Field visits to local forests for NTFP assessment, Learning field inventory techniques for NTFP assessment. Processing and Value Addition Processing on drying, packaging, and packing of NTFPs, study of Honey processing, Study of Triphla and Chawanprash formulation and processing Study of medicinal plant processing, Study of essential Oil extraction and product formation, Study of Mushroom based value addition practices, Product development techniques for NTFP-derived products. Quality Control and Entrepreneurship- Quality control measures for NTFP products, Entrepreneurship skills specific to NTFP-based enterprises, Market analysis and supply chain management for NTFP-based products.

Suggested Reading

1.Azamal Husen, Rakesh Kumar Bachheti, Archana Bachheti(2021).Non-Timber Forest Products Food, Healthcare and Industrial Applications, Springer Cham ISBN978-3-030-73076-5.

2. D. D. Tiwari (2015).Managing Non-Timber Forest Products (Ntfps) As An Economic Resource Write And Print Publications; First Edition Isbn-10 : 9789384649005

3. Charlie Shackleton, Patricia Shanley, Sheona Shackleton.(2011) Non-Timber Forest Products in the Global ContextSpringer Berlin Heidelberg.

4. Jeene H. de Beer, Melanie J. McDermott(1996).The Economic Value of Non-timber Forest Products in Southeast AsiaNetherlands Committee for IUCN.

5. Rana Bahadur Rawal (2020). Sustainable Management of Non-Timber Forest Products. The Role of a Market Price Information System GRIN Verlag

Course Outcomes:

CO1. Students will be aware of the importance and uses of Non timber forest products.
CO2. Students will know how to collect, process and generate value addition of some major NTFPs.
CO3. Students will have the opportunity for becoming NTFP based entrepreneur and provide livelihood generation.

Minor 5 - COMMERCIAL NURSERY PRODUCTION **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUEML1 FOUEMP1	3	-	1	5 hours	30	70	100	200	4

Course objectives:

1. To learn about the scope, importance and practice of nursery and its types.
2. To know about the management involved in establishing commercial nursery.
3. To be aware of the financial and marketing strategies in commercial nursery.

Theory

Introduction: definition, types of nursery, importance, and scope of commercial nursery production; plant propagation techniques: through seeds – seed formation, maturation, dormancy, seed treatment and germination, Vegetative propagation; cutting, layering, budding, and grafting. Nursery management: site selection, site and nursery bed preparation, preparation of various potting mixture, nursery layout, choice of species, sowing and planting, pest and disease management, soil and fertilizer management, irrigation and water management; Nursery Business Management; principles, law of diminishing return, decision making, cost and price principles, labour efficiency measures; Marketing and Sales Strategies; classification, price determination under different market situation, demand and supply and factors affecting the market, marketing efficiency-measurement methods, marketing cost, margin and price spread-concepts and applications types of market integration; Financial Management; importance and preparation of financial sheet, balance sheet preparation with reference to profit and loss accounts, Entrepreneurship Development.

Practical

Preparation of nursery bed, plant propagation by cutting, grafting, layering, budding. Calculation of fertilizer and composting mixture for different plantations, calculation of cost of production, preparation of farm records and ledger file. Preparation of potting mixture, Exercises on financial analysis of production, studies of marketing channels of different nursery products, costs, margin and price spread for different nursery and plantation crops, working capital analysis of nursery, balance sheet preparation, price determination of any nursery products under the different market situation, measurement of marketing efficiency

Suggested Readings

1. Hartmann and Kester, Plant Propagation, Principles and Practices, New Delhi, Practice Hall of India. Private Limited. (2002)
2. Kumar, Vinod, Nursery and Plantation Practices in Forestry, Jodhpur, Scientific Publisher
3. Joshi SS and Kapoor TR. 2001.Fundamental of Farm Business Management, Kalyani Publication, India.
4. Panda SC. 2011. Farm Management and agricultural marketing. Kalyani Publishers.
5. Makchas JP &Malcolm LE.1986. Economics of Tropical Farm Management. Cambridge
6. Univ. Press.
7. Nautiyal JC. 1988. Forest Economics, Principles and Applications; Natraj Publ.
8. Panda SC 2011.Farm management and Agricultural Marketing, Kalyani Publishers

Course Outcomes:

CO1. Students will learn about the scope, importance and practice of nursery and its types.
CO2. Students will know about the management involved in establishing commercial nursery.
CO3. Students will be aware of the financial and marketing strategies in commercial nursery.

Minor 6 - INDUSTRIAL PLANTATION **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUFML1 FOUFMP1	3	-	1	5 hours	30	70	100	200	4

Course objectives:

1. To learn the concept and needs of Industrial plantation.
2. To know about the choice and management practices of tree species in industrial areas.
3. To evaluate the site quality and suggest appropriate plantation strategy for industry affected lands.

Theory

Industrial plantations-definition, concept and scope. The need of Industrial plantation, Major pollutants of the industrial areas and role to tree and vegetation, Short rotation and long rotation plantations, major industries and their status in India. Planning for the plantation, project preparation, and appraisal and project implementation- feasibility studies. Choice of species- establishment- maintenance-Nutrition in plantations. Major pest and disease of plantations and control measures. Site quality evaluation, stand basal area- site index concept in plantation forestry- plantation productivity assessment- growing stock assessment- MAI, sustainability of plantations. Carbon sequestration analysis of the plantation using non-destructive approaches. Plantation records- plantation journal. Economic factors in plantation development- social and cultural considerations.

Practical

Visit Industrial plantations-study their management and functioning- Exposure to plantation project preparation- economic evaluation and feasibility studies of plantation projects. Planting operations- study of tending techniques. Planting methods and techniques for different types of plantations, Species evaluation, growing stock data collection, carbon stock evaluation, identification of different plant species of the industrial areas.

Suggested Readings

1. G.D., E. K. S. Nambiar, E.K.S 1984. Nutrition on Plantation Forests. Academic Press, 1984 -Nature - 516 pages Evans, J. 1992.
2. Plantation Forestry in the Tropics, 2nd edition. Oxford, UK, Clarendon Press. 477 Report of the ICAR Fifth Deans' Committee Evans, J. and Turnball, J.W. 2004.
3. Plantation Forestry in the Tropics: The Role, Silviculture and Use of Planted Forests for Industrial, Social, Environmental and Agroforestry Purposes. OUP Oxford, 467p. Krishnapilley. 2000.
4. Silviculture and Management of teak plantations. Unasylva. 201. Vol 51. 14-21p Nambiar, E.K.S. and Brown, A.G. 1997.
5. Management of Soil, Nutrients and Water in Tropical Plantation Forests. Australian Centre for Internat. Agricultural Research. 371p. Nambiar, E.K.S., Cossalter, C and Tiarks.A. 1998.
6. Site Management and Productivity in Tropical Plantation Forests. Workshop Proceedings, South Africa. Suzuki, K., Ishii, K., Sakurai, S. and Sasaki, S. 2006. Plantation Forestry in the Tropics. Springer Tokyo.

Course Outcomes:

CO1. Students will learn the concept, needs and importance of Industrial plantation.

CO2. Students will know about the choice and management practices of tree species in industrial areas.

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CO3. Students will be able to evaluate the site quality and suggest appropriate plantation strategy for industry affected lands.

Minor 7 - ENVIRONMENTAL AUDIT **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUGML1 FOUGMP1	3	-	1	5 hours	30	70	100	200	4

Course objectives:

1. Understanding the role and process of environmental management and auditing.
2. Learn the steps involved in EIA processes.
3. Create awareness on various environmental aspects and sustainable development goals.

Theory

Environmental audit for city and industries, Concept of auditing environment: principle, needs and scope, Environmental Impact Assessment, Environmental Auditing, Importance, Process, Auditors Responsibilities, Limitations, Environment Management System and Standards, Green audit, Energy audit, Components of environment audit, Introduction To Solid Waste Management, water harvesting and usage of water, E-Waste Management, Carbon Foot Prints, Greenery analysis, Concepts in Environmental Management, Approaches, Ethics and Sustainable Development.

Practical

Case studies of Environmental audit, Case studies of EIA, visit to Industries, Thermal plant, Coal Plant etc., Conduct a green audit of some institutional practices, Preparation of Environmental audit report, Preparation of EIA report. Use of online tools and platform for environmental audit.

Suggested Readings

1. Botkin and Keller. (2012). 'Environmental Science'. John Wiley & Sons Inc., Wiley India (P) Ltd., New Delhi. Eighth Edition.
2. Krishnamoorthy, B. (2009). Environment Management -Text and Practices, New Delhi: Prentice Hall India. www.prenticehall.india.org second edition
3. Rajgopalan R., (2016). 'Environmental Studies - from crisis to care', Oxford University press, New Delhi. Third Edition.
4. Santra S.C., (2014). 'Environmental Science', New Central Book Agency Pvt. Ltd, Kolkata. Third Edition.
5. Karpagam M. and Jaikumar G. (2010), 'Green Management – Theory and Applications' Ane Books Pvt. Ltd. New Delhi.
6. Jayamani C. V. and Vasanthagopal R. (2012), 'Environmental Management', New Century Publications, New Delhi.
7. Asthana D. K. and Asthana M. (2012), A Textbook of Environmental Studies, S. Chand & Company Ltd., New Delhi.
8. Kulkarni V. and Ramchandra T.V. (2006) – 'Environmental Management', Capital Publishing Company. New Delhi.

Course Outcomes:

CO1. Students will understand the role and process of environmental management and auditing.
CO2. Students will learn the steps involved in EIA processes.
CO3. Students will be able to create awareness on various environmental aspects and sustainable development goals.

Minor 8 - URBAN FORESTRY AND DESIGNING **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUHML1 FOUHMP1	3	-	1	5 hours	30	70	100	200	4

Course objectives:

1. Understanding the role of urban forest management and the scientific aspects.
2. To measure and analyse urban forest structure and its functions, ecosystem services and values.
3. To develop problem-solving skills for management issues involving urban and urbanizing forests.

Theory

Urban Forestry: Introduction, objective and scope. Urban Forest environment. Urban Forest structure and functions. Ecosystem services and benefits of urban forestry. Street, roads and park tree inventories. Tree species selection for street, parks and urban area. Urban Forest trees: management, planning and maintenance. Urban green spaces & Wildlife. Urban forestry ordinances. Role of the local community in urban forest management. Significance of Urban Forestry in pollution control and quality urban life. Carbon footprint calculation in the urban green area.

Practical

Case studies of urban forestry of urban areas of Chhattisgarh, Identify few success stories of urban forestry development in Bilaspur city. Identification of various types of forest tree species found in urban environment. Species selection for urban forestry. Study of Ecosystem services of Urban forestry.

Suggested Readings:

1. Malcom Fisher (1999) - Urban Forestry: Planning and Management. *Syrawood Publication House.*
2. V.K. Prabhakar (2000) – Forestry and Forest Resources. *Anmol Publication, New Delhi.*
3. S.S. Negi (1989) – Urban and Recreational Forestry. *International Book Distributors, Dehradun.*
4. S.S. Negi (2003) – Manual of Forestry. *Bishan Singh, Mahendra Pal Singh, Dehradun.*

Course Outcomes:

CO1. Students will understand the role of urban forest management and its scientific aspects.
CO2. Students will know how to measure and analyse urban forest structure and its functions, ecosystem services and values.
CO3. Students will be able to develop problem-solving skills for management issues involving urban and urbanizing forests.

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Minor 9 - ECOTOURISM **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUHML2 FOUHMP2	3	-	1	5 hours	30	70	100	200	4

Course objectives:

1. To familiarize students with principles, basic terminology and current situations of Ecotourism.
2. To identify the major components of ecotourism and conditions needed for successful ecotourism destinations.
3. To develop ideas about various livelihood aspects of ecotourism industries.

Theory

Ecotourism: definition & concept. Ecotourism in national & Global context. Components of Ecotourism. Types of ecotourist, ecotourism and education, Ecotourism and community, Ecotourism resources; identification, listing & categorization (natural, built and events). Ecotourism; Transportation, services and facilities, knowledge, skill, attitude and commitment of ecotourism providers. Ecotourism-based employment and scope, developing ecotourism product. Ecotourism and environment. Ecotourism and natural resource conservation. Ecotourism in protected area. Community-based ecotourism. Code of ethics for ecotourism. Best practices and guidance. Case studies of eco-friendly practices in ecotourism industries.

Practical

Case studies of ecotourism of various tourist places of Chhattisgarh. Identify few success stories of ecotourism development in Bilaspur city. Prepare chart and models for Code of ethics applicable in ecotourism sites. Study the role of community in ecotourism.

Suggested Reading

1. Buckley, R. (2003). Case studies in ecotourism. Cambridge: CABI.
2. Fennell, D.A. (1999). Ecotourism: an introduction. London: Routledge.
3. Ceballos-Lascurain, H. (1996). Tourism, ecotourism, and protected areas. Gland: IUCN
4. Wearing, S. and J. Neil. (1999). Ecotourism: impacts, potentials, and possibilities. Oxford: Butterworth-Heinemann.

Course Outcomes:

CO1. Students will familiarize with principles, basic terminology and current situations of Ecotourism.

CO2. Students will be able to identify the major compoeents of ecotourism and conditions needed for successful ecotourism destinations.

CO3. Students will be able to develop ideas about various livelihood aspects of ecotourism industries.

MULTIDISCIPLINARY COURSES

Multidisciplinary 1- KNOW YOUR FOREST **(Credit- 3)**

2. Forest Resources & Value addition
3. World of Forest Trees

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
FOUAMDL1	3	-		3 hours	30	70	100	3

Course Objectives:

1. Describe the importance of forests in ecological, economic, and social contexts.
2. Identify different types of forests and their key characteristics.
3. Explain the components of forest ecosystems and their inter-relationships.
4. Analyse the biodiversity found in forests and its significance.
5. Recognize the threats to forest ecosystems and formulate conservation strategies.

Theory

Definition and significance of forests, historical and cultural perspectives on forests, forests and their role in climate change mitigation, characteristics and distribution of different forest types in India, Indian State of Forest report (ISFR), forest ecosystem, floral and faunal diversity, medicinal plants and their significance, threats to forest ecosystems (deforestation, habitat loss, invasive species), conservation strategies, tribal communities and their role in forest conservation.

Suggested readings.

1. Champion, H.G. and Seth, S.K. 1968. The revised survey of the forest types of India. Manager of Publication, Govt. of India, Delhi.
2. Pradip Krishan (2013). Jungle trees of central India, Pengain Book distributors India.
3. Indian state of Forest report (ISFR) published by Forest Survey of India (FSI). Accessed from the official website of FSI.
4. Gaston, K.J and Spicer, J.I. 2004. Biodiversity: An Introduction. Blackwell Publishing Company, USA.
5. Nautiyal, S and Kaul, A.K. 1999. Forest Biodiversity and its conservation Practices in India. Oriental Enterprises, Dehradun.
6. Ashok Malik (2008) Dynamics of Forest ecosystem. Today and Tomorrow Publishers, New Delhi.

Course Outcomes:

CO1. Students will gain knowledge on the ecological, economic, and social importance of forests.
CO2. Students will have the knowledge about the components of forest ecosystems and their inter-relationships.
CO3. Students will know the threats to forest ecosystems and biodiversity.

SKILL ENHANCEMENT COURSES

SEC- 1: NURSERY TECHNOLOGY Credit- 2+1

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
FOUASL1 FOUASP1	2	-	1	4 hours	30	70	100	200	3

Course Objectives:

1. To gain knowledge on the types of nurseries used for raising seedlings.
2. To be able to layout and prepare nursery beds for seedling production.
3. To enhance knowledge on different nursery management techniques and methods.

Theory

Nursery, introduction, objectives and scope, types of nurseries, choosing nursery site, design and layout of the nursery, preparation of nursery beds, producing plant from seed, seed handling, dormancy and treatments, methods of sowing, time and season, potting mixtures, transplanting of young seedlings, plant containers, compost and mulches, nutrient and soil management, disease and pest control, sale and marketing.

Practical

Site selection and its assessment, preparation of different types of nursery bed, study of plant containers, seed treatment, seed sowing, preparation of potting mixtures, application of mulches, application of weedicides, Compost preparation, Tools and instruments, nursery record. Assessment of plantation site, visit of nursery and plantations, pruning methods in newly and old plantations, fertilizer and weed management practices. Marketing management of nursery grown seedlings.

Suggested Readings:

1. Keats C Hall. 2003 Manual on nursery practice. Forest Department, Jamaica. E book
2. Kumar, Vinod, (2016), Nursery and Plantation Practices in Forestry, Scientific publishers India.
3. Luna RK. (2006). Plantation forestry in India. International book distributor, Dehradun India.
4. Pawar Pankaj (2007). Practical Manual of plantation forestry. Scientific publisher, Jodhpur
5. Sharma and Singh NP. (2011). Soil and orchard management. Daya Publishing House, Delhi

Course Outcomes:

CO1. Students will gain knowledge about various types of nurseries used for raising seedlings.
CO2. Students will be able to layout and prepare nursery beds for seedling production.
CO3. Students will be aware of the different nursery management techniques and methods.

(2) Wildlife Biology
(3) Afforestation Techniques

VALUE ADDED COURSES

VAC-1: Environmental Education-I **Credit- 2**

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
FOUAVL1	2	-		2 hours	30	70	100	2

Course objectives:

1. Develop a critical understanding of the environmental issues of concern
2. Understand the concept of natural resources; identify types of natural resources, their distribution and use with special reference to India.
3. Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.
4. Understand the concepts of ecosystems and its role in environment.

Unit I. Humans and the Environment-

The man-environment interaction: Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation. The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

Unit II. Natural Resources and Sustainable Development

Overview of natural resources. Classification of natural resources- biotic and abiotic, renewable and non-renewable. Biotic resources: forests, grasslands, wetlands, wildlife and aquatic. Water resources: Types of water resources- fresh water and marine resources. Renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells. Introduction to sustainable development: Sustainable Development Goals (SDGs).

Unit III. Environmental Issues: Local, Regional and Global

Environmental issues and scales: Extents of local, regional, and global phenomena. Pollution: Impact of sectoral processes on Environment; Types of Pollution- air, noise, water, soil, thermal, radioactive, municipal solid waste, hazardous waste. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change. Disasters – Natural and Man-made

Unit IV. Conservation of Biodiversity and Ecosystems

Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; the role of traditional knowledge, community-based conservation; Gender and conservation.

Unit V. Environmental Pollution and Health

Understanding pollution: Definition of pollution; Point sources and non-point sources of pollution. Air pollution. Water pollution: Sources of water pollution; water quality. Soil pollution and solid waste. Soil pollutants and their sources. Solid and hazardous waste. Noise pollution: Sources of noise pollution; Noise standards; adverse impacts on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

Unit VI. Climate Change: Impacts, Adaptation and Mitigation

Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming. Green House Gas (GHG) reduction vs. sink enhancement. Concept of carbon intensity, energy intensity and carbon neutrality. National and international policy instruments for mitigation, and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage. National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.

Suggested readings

1. Erach Bharucha (2021).Text Book OF ENVIRONMENTAL STUDES FOR UG 3RD Edition. Orient Blackswan Pvt. Ltd. ISBN 9389211786

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2. Sharma PD and Sharma PD. (2012). Ecology And Environment. Publisher: Rastogi Pblications, ISBN:9788171339051, 8171339050
3. Deswal A. And Deswal S. (2013). A Basic Course In Environmental Studies, Dhanpat Rai & Co. ISBN 9788177000023
4. इराक भरुचा (२०२१ .एन.बी .आई एस .पर्यावरण अध्ययन .9789354426001 ,
पृष्ट ३१६ .तृतीय संस्करण भाषा हिंदी. ओरिएंट ब्लैक स्वान प्रा .लिमिटेड .
5. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
6. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
7. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future. 10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.
8. John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS)
9. Harper, Charles L. (2017) Environment and Society, Human Perspectives on Environmental Issues 6th Edition. Routledge.
10. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
11. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
12. Sinha, N. (2020) Wild and Wilful. Harper Collins, India.
13. Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
14. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK
15. Miller, G. T., & Spoolman, S. (2015) Environmental Science. Cengage Learning.
16. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/standards/
17. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
18. Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
19. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/.
20. Adenle A., Azadi H., Arbiol J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world, Journal of Environmental Management, 161 (15): 261-275.
21. Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213.

VAC-2: Environmental Education-II **Credit- 2**

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
FOUBVL1	2	-		2 hours	30	70	100	2

Course objectives:

1. Develop an understanding of pollution through experiential learning.
2. Acquire knowledge on major international institutions and programmes and their role in conservation of the environment.
3. To learn about the biodiversity management practices, plantation care activities and nature care methods.
4. Acquainted with the major international treaties and our country's stand on and responses to the major international agreements.

UNIT I. Environmental Management

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights, Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001 Concept of Circular Economy. Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme

Unit II. Environmental Treaties and Legislation

An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; COP, Major International Environmental Agreements: CBD; UNCCD; Vienna Convention; Montreal Protocol; UNFCCC; Kyoto Protocol; Paris Agreement; Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; National Green Tribunal; Major International organizations and initiatives: UNEP, IUCN, WCED, UNESCO, IPCC, MAB programme.

Unit III. Case Studies and Field Work

The students are expected to be engaged in some of the following or similar identified activities: Discussion on one national and one international case study related to the environment and sustainable development.

1. Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
2. Participation in plantation drive and nature camps.
3. Documentation of campus biodiversity.
4. Campus environmental management activities such as solid waste disposal, water Management and sanitation, and sewage treatment.

Suggested Readings

1. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press.
2. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
3. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/
4. UNEP (2007) Multilateral Environmental Agreement Negotiator's Handbook, University of Joensuu, ISBN 978-952-458-992-5
5. Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press.
6. India Code – Digital repository of all Central and State Acts: https://www.indiacode.nic.in/

21/7/2023

Curriculum and Credit Framework

FOR

M.Sc. FORESTRY & ENVIRONMENTAL SCIENCE

(w.e.f. Academic session:2023-24)

"SCHOOL OF NATURAL RESOURCES"

DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES

GURU GHASIDAS VISHWAVIDYALAYA

(A Central University established by the Central University Act.2009 No. 25 of 2009)

BILASPUR-495009, CHHATTISGARH

3.7.2023

Course Structure

M.Sc. Forestry and Environmental Science (2 -Years / 4- Semester)

Semester	Course Opted	Course Code	Name of the Course	Credit	Hour/ week	Marks
I[st] SEM	Core-01	FOPATT1	Advances in Silviculture	3	3	100
	Core-01 Practical	FOPALT1	Advances in Silviculture	1	3	100
	Core -02	FOPATT2	Forest Biotechnology & Tree Improvement	3	3	100
	Core -02 Practical	FOPALT2	Forest Biotechnology & Tree Improvement	1	3	100
	Core-03	FOPATT3	Forest Biometry, Surveying & Engineering	3	3	100
	Core-03 Practical	FOPALT3	Forest Biometry, Surveying & Engineering	1	3	100
	Core -04	FOPATT4	Forest Soil and Watershed Management	3	3	100
	Core -04 Practical	FOPALT4	Forest Soil and Watershed Management	1	3	100
	Core-05	FOPATT5	Wildlife Management and Conservation	3	3	100
	Core-05 Practical	FOPALT5	Wildlife Management and Conservation	1	3	100
	TOTAL			**20**	**30**	**1000**

II[st] SEM	Core -06	FOPBTT1	Forest Management, Remote Sensing & GIS	3	3	100
	Core -06 Practical	FOPALT1	Forest Management, Remote Sensing & GIS	1	3	100
	Core -07	FOPBTT2	Agro-Forestry and Farm Forestry	3	3	100
	Core -07 Practical	FOPBLT2	Agro Forestry and Farm Forestry	1	3	100
	Core-08	FOPBTT3	Forest Product & Utilization	3	3	100
	Core-08 Practical	FOPBLT3	Forest Product & Utilization	1	3	100
	Core -09	FOPBTT4	Policy, Acts and Legislation in Forestry, Wildlife and Environment	3	3	100

	Core -09 Practical	FOPBLT4	Policy, Acts and Legislation in Forestry, Wildlife and Environment	1	3	100
	Core -10	FOPBTT5	Environment Management and Sustainability	3	3	100
	Core -10 Practical	FOPBLT5	Environment Management and Sustainability	1	3	100
	TOTAL			**20**	**30**	**1000**
	Summer Internship (Forest/ industry/ Institution)			**Non-credit**		

III^rd SEM	Core -11	FOPCTT1	Forest Protection	3	3	100
	Core -11 Practical	FOPCLT1	Forest Protection	1	3	100
	Core 12	FOPCTT2	Wood Science and Technology	3	3	100
	Core 12 Practical	FOPCLT2	Wood Science and Technology	1	3	100
	Core-13	FOPCTT3	Forest Ecology and Biodiversity Conservation	3	3	100
	Core-13 Practical	FOPCLT3	Forest Ecology and Biodiversity Conservation	1	3	100
	Core 14	FOPCTT4	Industrial Safety, Health and Environment	3	3	100
	Core-14 Practical	FOPCLT4	Industrial Safety, Health and Environment	1	3	100
	Core 15	FOPCTT5	Forest and People	3	3	100
	Core-15 Practical	FOPCLT5	Forest and People	1	3	100
	TOTAL			**20**	**30**	**1000**

IV^th SEM	Core - 16	FOPDTT1	Forest Statistics and Research Methodology	3	3	100
	Core - 16 Practical	FOPDLT1	Forest Statistics and Research Methodology	1	3	100
		FOPDPJ1	Dissertation	20	64	400
	TOTAL			**24**	**70**	**600**
Grand total				**84**	**160**	**3600**

Programme Outcome:

PO1: Fundamental knowledge: The students will be able to apply knowledge of Forestry and Environmental Sciences for managing the forest resources and its development.

PO2: Problem investigation and analysis: The students will have the competence to investigate, and possess analytical skills to identify, formulate and solve real time Forestry and Environmental issues and provide a cutting edge solution.

PO3: Society: The students will apply the knowledge of Forestry to assess the resources for the benefits and wellbeing of forest dwellers and society.

PO4: Ethics: The students will apply ethical principles and commit to professional ethics, responsibilities and norms of the forestry and environment protection, and conservation practice.

PO5: Team work: The students will function effectively as an individual member or as a leader in diverse teams and multidisciplinary activities

PO6: Communication: The students will be able to communicate effectively by presentations and writing reports of the activities related to forestry

PO7: Management: The students will be able to manage the forest resources for mitigating climate change and sustainable future.

PO8: Life-long learning: The students will be engaged in independent lifelong learning in the broadest context of forestry operation and management.

Program Specific Outcomes:

PSO1: Student will develop strong competencies in the field of Forestry and Environmental Sciences and its application in a technology-rich, interactive environment.

PSO2: Students will develop strong skills on silvicultural activities, forest genetics and tree breeding, forest survey & mapping, forest management planning, forest based industries, environmental sustainability using recent technologies and tools.

PSO3: To prepare the students for employment in Forestry, environmental sciences and allied sectors and to meet the workforce demand of government and industries.

3/7/2023

SEMESTER-I

PAPER I. ADVANCES IN SILVICULTURE **CR.4 (3+1)**

Course Objectives:

1. To develop understanding of student on the characteristics of various tree species and Forest classification of India.
2. To perform the regeneration survey, production techniques of tree species and their adaptations to different type of environments.
3. To acquire knowledge on forest operations required for sustainable forest management

Theory

Principles of Silviculture, objective and scope, relationship with the other branch, Forest ecosystem-structure and functioning, community development, competitive interactions in forest communities, forest succession. Eco-physiology of tree growth, factors of the locality, bioclimate and microclimate effect, stand dynamics-forest succession, major forest formations- classification, distribution, composition and structure. Vegetation dynamics- species richness-diversity indices. Vegetation forms of India and their productivity. Classification of world's forest vegetation, forest types and their distribution, Forest stand development – stand development, even- aged and uneven-aged stands and site quality. Introduction and importance of nursery. Types of nurseries-temporary and permanent, component of modern nursery, bare root, containerized and clonal nursery. Pre-sowing seed treatments, seed sowing and intermediate operations, viz., pricking, watering, fertilization, weeding and hoeing. Natural and artificial regeneration. Tending operation. Regeneration of important forest tree species *(Shorea robusta, Tectona grandis, Gmelina arborea, Eucalypsus spps. Dalbergia sissoo, Bamboo spps .Cedrus deodara* and *pinus roxburghii), r*egeneration survey and techniques.

Practical

Acquaintance with various technical terms of silviculture. Study the forest composition. Recording the observations on shoot developement, growth rings, crown developement, leafing, flowering, and fruiting in *(Shorea robusta, Tectona grandis, Gmelina arborea, Eucalypsus spps. Bamboo spps Cedrus deodara, Dalbergia sissoo).*Study of site factors like climatic, edaphic, physiographic and biotic. Study of natural regeneration, Afforestation and Reforestation success. Layout of nursery bed for sowing. Classification of world's forest vegetation. Visit to forest areas to study forest composition, classification, factors of locality, site quality, form and growth of forest trees- study plant succession- study stand density, changes on productivity- thinning effects.

Suggested Readings

Dwivedi AP. 1992. *Agroforestry: Principles and Practices.* Oxford and IBH.

Dwivedi AP. 1993. *A Text Book of Silviculture.* International Book Distributors, Dehradun.

Khanna LS. 1996. *Principle and Practice of Silviculture.* International Book Distributors.

Smith DM, Larson Bc, Ketty MJ &Ashton PMS. 1997.

Jha, L. K.2014.*Advances in Agroforestry*, Today & Tomorrow's Printers and PublishersNew Delhi.

Chandra KK and Kumar R. 2022. Practical book on forestry. Scientific publication, Jodhpur, Rajasthan, India.

Mishra, S R. 2010.*Textbook of Dendrology*, Today & Tomorrow's Printers and Publishers New Delhi

Patra, A K. 2013.*Agroforestry: Principles and Practices*,Today& Tomorrow's Printers and PublishersNew Delhi.

PradeepKrishan. 2013. *Jungle trees of Cenrtral India*. Penguin Books India.

Smith DM, Larson BC, Ketty MJ, and Ashton PMS.1997.*The Practicves of Silviculture- Applied Forest Ecology*.John Wiley & Sons.

Raj, Antony Joseph & S B Lal. 2014.*Agroforestry: Theory and Practices*, Today & Tomorrow's Printers and PublishersNew Delhi

Course Outcome:

1. Students will be expertise on the identification of forest tree species and growing stocks of forest and nursery establishment.
2. Student will be competent on tree species requirement under different site conditions.
3. Students will be acquainted to various tending operations for forest, stand management and manage growing stock of forest.

	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1		3	1	1	3	3	3	1
CO2	3	3	3	1	2	1	3	2	3	3	2
CO3	3	2	2	1	3	1	3	3	3	3	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER II. FOREST BIOTECHNOLOGY & TREE IMPROVEMENT

CR.4 (3+1)

Course Objectives:

1. To acquaint the students about general principles of tree breeding for important tree species.
2. To understand the seed orchards, Clonal orchards, seed production areas, plus trees, etc.
3. To acquire the knowledge of biotechnological tools for genetic diversity improvement and protection.

Theory

General concept of forest tree breeding, tree improvement and forest genetics. Reproduction in forest

trees, dimorphism pollination mechanisms. Pollen dispersion distances, pollinators and their energetics. Attractants for pollinators. Pollen handling forced flowering for seed orchard manipulation. Pollination mechanisms. A Variation in trees importance and its causes. Natural variation as a basis for tree improvement. Geographic variations - Ecotypes, clines, races and land races. Seed, seed formation, dispersal, storage, stratification and seed dormancy. Selective breeding methods- mass, family, within family, family plus within family. Plus tree selection for wood quality. Progeny and clone testing. Seed orchards - type, functions and importance. Genetic testing- mating designs and field designs. Progeny and clone testing estimating genetic parameters and genetic gain, clonal and breeding values. Average performance of half sibs and full- sibs. GXE interaction in trees. Heterosis breeding: inbreeding and hybrid vigour. Manifestation and fixation of heterosis. Species and racial hybridization. Indian examples - Teak, Sal, Shisham, Eucalypts, Acacias, Pines and Poplars. Polyploidy, aneuploidy and haploidy in soft and hardwood species. Molecular tools for developing disease resistance trees. Transgenic plants.

Biotechnology in tree improvement Mutation breeding. Tissue Culture, Vegetative propagation, clonal propagation, Micro-propagation, Genetic engineering, Transgenic plants, Molecular marker and its application in forestry.

Practical

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

Suggested Readings

Khan IM. 2014 Forest Biotechnology, Today and Tomorrow Printers and PublishersNew Delhi.

Mandal AK & Gibson GL. (Eds). 1997. *Forest Genetics and Tree Breeding.* CBS.

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

P. Shanmughavel, 2004.*Tree Improvement and Biotechnology*, Pointer.

Russel Haines, 1996. *Biotechnology in Forest Tree Improvement with Special Reference to DevelopingCountries*.. Reprint, Dehradun.

White J.W. 1976. *Introduction to Forest Genetics.*Academic Press.

Zobel BJ &Talbert J. 1984.*Applied Forest Tree Improvement.*John Wiley &Sons.

Course Outcome:

1. Ability able to identify the source of variation in tree species.
2. Student perform survey for quality assessment of plus tree, seed orchard, and clones.
3. The students will be enabled to establish SPA, Cos for sustain seed supply.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	3	3	3	3	3
CO2	3	3	1	1	1	1	3	3	3	3	3
CO3	3	3	1	1	1	1	3	3	3	3	3

Weightage: 1-Sighily; 2-Moderately; 3-Strongly

PAPER III. FOREST BIOMETRY, SURVEYING & ENGINEERING Cr.4 (3+1)

Course Objectives:

1. To acquaint students about tree measurements and forest Inventorization.
2. To develop skills for estimating the growing stock of forest using various tools and techniques.
3. To have the knowledge for conducting forest survey, and forest engineering aspects.

Theory

Measurement of tree parameters: girth, diameter, height and form factor. Estimation of log volume and volume of standing trees and forest stands. Estimation of tree age and dendrochronology for growth history and climate change studies, growth and yield of individual tree and forest stands. Stump analysis and stem analysis for determining past growth. Preparation of volume table, yield table, stand table & its application in forestry. Forest inventory, sampling methods adopted in forestry. Quantification of regeneration and stand establishment. Measurement of crown density and crown ratios. Growth and yield prediction models – their preparation and applications.

Forest surveying: Chain survey, plane table and compass survey. Forest Engineering: Building materials and its quality testing, Design and construction of forest roads and bridges.

Practical

Measurement of girth and diameter of plantation and forest, Determination of tree height and form factor, volume calculation of felled and standing trees. Estimation of tree age, Volume table preparation, Application of sampling procedures, Handling of GPS, preparation of yield and stand table. Application of different sampling methods; Quantification of regeneration and stand establishment; Measurement of crown density and crown ratios, Dendrochronological studies.

Survey of forest and plantations using chain, plane table, compass, total station, measurement of road camber and road profile. Identification of building materials and its field testing, visit of different types of bridges.

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Suggested Readings

Chaturvedi A N and Khanna L S. 1994. Forest Mensuration. International Book Distributor. Dehradun, India

Masani, NJ. 1995. Forest Engineering without tears, Natraj Publisher, Dehradun

Manikandan K and Prabhu S. 2012. Indian Forestry, Jain Brothers, New Delhi

Ram Parkash 1983. Forest Surveying.KhannaBandhu Book Publisher India.

Sharpe GW, Hendee CW & Sharpe WE. 1986. Introduction to Forestry. McGraw-Hill.

Simmons CE. 1980. A Manual of Forest Mensuration. Bishen Singh MahenderPalSingh, Dehradun.

Ram Parkash 1983. Forest Engineering.International Book Distributor, Dehradun, India.

Course Outcome:

1. Students will be able to demonstrate the use of common forestry equipments, calculate tree age and yield assessment of forest stand.
2. Students will be able to determine the growing stock of the forest and plantation.
3. Students will be well equipped for performing forest survey related activities.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	2	3	3	3	3
CO2	3	3	2	1	3	1	3	3	3	3	1
CO3	3	3	1	1	3	1	2	3	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER IV. FOREST SOIL AND WATERSHED MANAGEMENT — CR.4 (3+1)

Course Objectives:

1. To understand and analyze different properties of forest soils and management of fertility and productivity.
2. To learn about the problems associated with tropical forest soils and their management.
3. To understand the concept of watershed and sustainable approaches for watershed management for improving the forest health.

Theory

Definition and importance of forest soils; Origin, classification and nomenclature of soils; forest soil physical, chemical and microbiological properties. Difference between forest soil and other arable soils, understanding of soil dynamics and influence upon forest composition stand regeneration, tree vigor and tree growth. Forest soil fertility determination, nutrient management in forest soil. Forest

soils and vegetation development. Soils of the major forest biomes – soils under different forest types. Soils and plant roots. Nursery soil management. Soil degradation-problems and impact on forest ecosystems; Forest fire and soil resilience; Forest soil pollution, maintenance and improvement of forest soil with special reference to tropical conditions. Forest floor – Organic horizons- litter dynamics- humus – types- organic matter decomposition-mineralization and immobilization of organic matter- nutrient cycling significance of C:N ratio, soil pH. Nitrogen fixation – rhizobium-free legume symbiosis, Frankia X non-legume symbiosis, nitrification and denitrification in forest ecosystems. Mycorrhizal association in forest soils. Watershed basic concept, social aspects of watershed management, watershed management practices, integrated watershed management, use of modern techniques in watershed management.

Practical

Determination of soil moisture, texture, porosity, bulk density, particle density and water holding capacity; Determination of pH, EC, organic C &N, Study of forest soil profile in field, . Studies on fertilizers, bio fertilizers and FYM uses in forest nursery, studies on drainage maps, characterization and delineation of watersheds, visits to nearby forest nursery and watershed areas.

Suggested Readings

A K Mani; R Santhi and K M Sellamuthu, 2008.*Fundamentals of Forest Soils*, Satish Serial Pub.

Dhuruva Narayana, V.V., Sastry, G. and Patnaik, V.S. 1990. *Watershed management.*ICAR Publication, New Delhi.

Matt Burshe Christian P. Giardina, Dave and Morris and Debora S. Page Dumroese 2019. Global change ion forest soils, Esiver Science Publisher.

Murty, J.V.S.1995. *Watershed management in India.*Wiley Eastern, New Delhi.

Singh, P.K. 2000.*Watershed management: Design and Practices*. E-media publications,Udaipur, India.

N.C. Brady 1990.*The Nature and Properties of Soils*: Macmillan Publishing Company, New York (10th Edition).

Negi S.S., 2000. *Forest Soils*, International Book Distributors, .

Osman, Khan Towhid, 2013. *Forest Soils: Properties and Management*, Springer Science publ.

D. Binkley and R.F. Fischer (2000).*Ecology and Management of Forest Soils* (fifth addition Willey & Blackwell Publisher)

S.A: Wilde 1995.*Forest Soils and Forest Growth, Periodicals* Express Book Agency, New Delhi, International Book Distributors, Dehradun.

Course Outcome:

1. The student will acquire sound knowledge on the physico-chemical and biological properties

of forest soils.

2. The students will be able to run different instruments used in soil analysis of forest soils.
3. The students will be enabled preparing watershed map and management plan.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	3	3	3	3	1
CO2	3	3	2	1	1	2	3	3	3	3	3
CO3	3	3	1	1	3	3	3	3	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER V: WILDLIFE MANAGEMENT AND CONSERVATION CR.4 (3+1)

Course Objectives:

1. To understand the animal behavior and their habitats for management.
2. To know the various conservation methods of wildlife for assessing the biodiversity.
3. Prepare students for wildlife census and wildlife management.

Theory

Introduction/Conservation ethics- Definitions, Values, Zoological classification, Sign and symptoms, Animals behavior & adaptations, Wild life Ecology, Basic concepts, Wildlife habits, Wildlife habitat and its component. Wildlife conservation: Definition, Concept, significance. Wildlife conservation movement, Wildlife conservation in India, In-situ and Ex-situ wildlife conservation, Role of protected area in wildlife conservation, some rare and threatened wildlife species of world particularly India, special project for endangered species, Project tiger, Gir Lion Project, Crocodile Breeding Project, Wildlife Conservation organization- National and International. Role of zoos parks and sanctuaries for conservation of wildlife. Ramsar wetlands. Wild life management: Wild life management its scope as a natural resource, current status of wildlife management. Tiger, Bear, Elephant, Rhinoceros, deer. Biological basis of management- animal population, shelter, food, WL Policy Legislation and administration policies and programmes. Wild life protection act 1972, Scheduled animals, Age and Sex determination, Tiger census, Preservation of biological material, National Park and Sanctuaries of (C.G). Biotelemetry, Forensic Analysis, Wildlife pathology, wildlife crimes, Human wildlife conflict, habitat development.

Practical

Study of mammals birds and animals in university premises, Identification of pugmark, evaluation of Roosting cover in university premises, Plotting of National Park and Sanctuaries on map. Visit and list the wildlife present in nearby zoo, sanctuaries, National Park. Evaluation of wildlife habitat and

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fodder development activities. Study of food habit of wild animals.

Suggested Readings

Agarwal, K.G.,2000. *Wildlife of India: Conservation and management*, Nidi Publishers India.

Gopal Rajesh.,1993. *Fundamentals of wildlife management*, Justice Home Publication, Allahabad.

Hosetti B.B, 1997. *Concept of Wildlife management*, Daya Publishing House, Delhi.

James, *A.* 1984 *Principles of wildlife management*, Inc. Bailey, John Wiley & Sons,New York.

Hunter, M.L. Jr.,1990. *Wildlife forest and forestry principals of managing forest for Biological diversity*, Printice Hall,.

Singh, S K., 2009. *Textbook of Wildlife Management*, Today & Tomorrow's Printers and Publishers New Delhi.

Stephen H, Berwick and V.B, Sharia, 1995.Wildlife *Research and management*, Oxford University Press, Oxford.

Course Outcome:

1. Student will be able to perform wildlife inventory and census survey.
2. Students will learn about the in-situ and ex-situ conservation methods of wildlife animals.
3. Students ability to have understanding of animal food habit and manage human-wildlife conflict.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6.	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	3	3	3	3	2
CO2	3	2	1	1	1	1	3	3	3	3	2
CO3	3	3	1	1	3	3	3	3	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEMESTER-II

PAPER I: FOREST MANAGEMENT, REMOTE SENSING & GIS Cr.4 (3+1)

Course Objectives:

1. To enrich the students on forest management, and its functions productive, protective, recreation and bio-aesthetic value.
2. To provide knowledge on criteria and indicators for forest evaluation and site assessment.
3. To develop competency on remote sensing and GIS techniques for forest survey and management.

Theory

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Principles of forest management and their applications. Forest division and organizational setup of MoEF&CC and State forest department. Development of forest management in India. Concept of Normality, Normal forest, Causes of abnormity is forest management Sustainable Forest Management, Rotation: Meaning and types. Increment, Types of increment, Yield: Types of yield, Yield regulation in regular forest, Yield regulation in irregular forest Management. Working circles, felling series, cutting section, coupes, periodic blocks, and felling cycles. Agro: Definition and types, Bamboo forest management. Working plans and working schemes, their role in nature conservation, biodiversity and other dimensions and control, working plan prescriptions. Site quality, Stand density, Criteria, and Indicators. Forest felling and silviculture system: Clear felling, Shelterbelt, Coppice system etc. Important forest organizations and institutes of India and World.

Remote Sensing definition, scope, source of energy and interaction with forest, EMR Spectrum concept, Orbit, Platform and Sensor, Multi-band concept, Satellite system and its use for forest mapping and management. GIS definition, Hardware, and software used, methods used in forest management, database, and modeling concept. Imagery concepts its interpretation and map preparation, LiDAR, and RADAR concept for forest. Application of RS & GIS for forest management and planning, forest covers type discrimination and change detection analysis.

Practical

Study of various records and forms maintained in Forest division with regard to management of forests under their control. Study of working plans of the forests. Toposheet reading, determination of scale and height on toposheets, introduction to different GIS software, conversion of file formats, image registration / geocoding, digitization, geo-referencing, Projection, File sub setting, mosaicing, unsupervised and supervised classification of forest, map preparation for forest cover, type, slope, LULC, fire, field visit for ground truthing.

Suggested Readings

Burrough P.A.1990. *Principles of GIS for Land Resources Assessment*, Oxford & IBH Lilesand T.M.

Clarke, Keith. 2011. *Geographical Information System*, Prentice Hall.

Dwivedi A.P. 1993. *A Text Book of Silviculture*, International Book Distributors, Dehradun.

J.B.Lal.2011.*Forest Management: Classical Approach and Current Imperatives*, NatrajPublishers, Dehradun.

Franklin, Steven. 2014. *Remote Sensing for Sustainable Forest management*, CRC Press.

John Wiley.*Remote Sensing and its application*. Universities Press

Kohl, Michael 2012. *Sampling Methods, Remote Sensing and GIS Multisource Forest Inventory*, Springer publication.

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Lillesand and Kiefer 2009.*Remote Sensing and Image Interpretation*, VI edition of John Wiley & Sons.

Lecture notes. 2000. *Photogrammetry and Remote Sensing*, module I, IIRS

Sen, Raj Kumar.2012. *Forest Management and Sustainable Development*,Today & Tomorrow's Printers and PublishersNew Delhi.

Course Outcome:

1. Student ability to perform forest evaluation based on criteria and indicators.
2. Students ability assessing forest productivity, increment and ecological aspects.
3. Students will be familiar on the use and procedure of remote Sensing and GIS and mapping using computer based software.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	2	3	3	3	1
CO2	3	3	2	1	1	1	3	3	3	3	2
CO3	3	3	2	1	1	2	3	3	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER II: AGRO-FORESTRY AND FARM FORESTRY CR 4 (3+1)

Course Objective:

1. To impart knowledge on the concept of agroforestry as a sustainable land use system
2. To acquainted knowledge on diagnosis and design of different agroforestry systems
3. To evaluate the site and establishment of climate smart agroforestry models for higher return.

Theory

Agroforestry: objectives, importance, potentials and limitations for implementations. Basis of classification of agroforestry systems and principles, indigenous vs. exotic, intraspecific variations, crown architecture of tropical/ temperate trees. Concept for selection of multipurpose trees. Overview and case studies of different agroforestry systems. Structural and functional attributes of agroforestry systems, shifting cultivation, taungya system, multiple and mixed cropping, alley cropping, silvopastoral systems, shelter-belts and windbreaks, energy plantations and home gardens. Role of trees in soil productivity and conservation- micro-site enrichment-litter and fine root dynamics, Soil productivity and management in agroforestry. Tree architecture and canopy management.

Tree-crop interphase- biological factors affecting form and function in woody and non-woody plant mixtures. Nature and types of interactions- positive and negative, aboveground and

belowground interactions- competition, complementarity in resource sharing.

Farm forestry, Wood lots, Community forestry and social forestry, linear strip plantations. Trends in agroforestry systems research and development, Diagnosis and Design –PRA-RRA tools in agroforestry problem diagnosis. Climate Change mitigation and adaptation through agroforestry.

Practical

Survey and analysis of land use systems in the adjoining areas; Study of tree crown architecture; Design and plan of suitable models for improvement; PRA-RRA tools in agroforestry problem diagnosis; Field survey and acquaintance with specialized features of trees, shrubs and fruit species and varieties for Agroforestry; Planting plans including wind breaks; Training and pruning of forest trees, shrubs and fruit trees for enhancing production in agroforestry system; Different methods for quantifying interactions; Studies on allelopathy; Effect, microclimate modifications, different plant mixtures, tree-soil-crop interactions; Measurement and interpretation of light interception in agroforestry systems; Interpretation of yield responses to shelter, soil and water, quantifying root distribution.

Suggested Readings:

Buck LE, Lassoie, Fernandes ECM 1999. Agroforestry in Sustainable Agri. Systems. CRC Press.

Kumar BM and Nair PKR. 2006. Tropical Homegardens: A Time-Tested Example of Sustainable Agroforestry. Springer publication.

Kumar BM and Nair PKR. 2013. Carbon Sequestration Potential of Agroforestry Systems: Opportunities and Challenges (Advances in Agroforestry). Springer publication.

Nair PKR and Latt 1998. Directions in Tropical Agroforestry Research. Kluwer. Nair PKR, Rai MR and Buck LE. 2004. New Vistas in Agroforestry. Kluwer

Ong CK and HuXley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.

Peter Huxley. 1999. Multiple Cropping with Woody and Non-Woody Plants. John Wiley and Sons Ltd, Oxford, United Kingdom.

Tejwani KG. 1994. Agroforestry in India. Oxford & IBH Publishing Co. Pvt Ltd.

Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.

Young A. 1997. Agroforestry for Soil Management. CABI.

Course Outcome:

1. Students will get exposure on agroforestry systems and outside forests.
2. Students will be able to develop hypothesis on D & D of agroforestry using PRA and RRA

techniques.

3. Students will be able to understand as a climate smart farming system for sustainable development.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	2	3	3	3	3
CO2	3	3	3	3	3	1	2	3	3	3	3
CO3	3	3	2	3	3	1	1	3	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER III: FOREST PRODUCT AND UTILIZATION

Course Objectives

1. To equip students on the status of forest products of Indian forests
2. To aware learners on economy status of different non wood products
3. To acquainted students on the processing, value addition and marketing procedures of forest products and its utilization pattern.

Theory

Supply and demand status of wood, export, and import of timber, its products, and channels. Brief status of solid wood, reconstituted, and handicraft industry, such as wood carving, basketry, executive desk accessories, furniture, joinery, cabinets, sports goods, sawmills, wood seasoning, flooring and paneling, automobile body building, wood treatment, wood preservation, building construction, packaging and boats. Industrial utilization of wood and bark. Classification of non-wood forest products like gums and resins, katha, dyes, tannins, oils, raw drugs, bamboo, canes and other products. Technologies for extraction of gums, resins, oleo-resin katha, dyes, tannins, oils, raw drugs and other products. Tendu leaves, Lac, and Sericulture. Utilization of various non wood forest products and their scientific management for processing, value addition, storage and marketing. Quality assessment of important products and their methods for storage.

Medicinal and aromatic plant wealth of India, Importance of medicinal and aromatic plants in human health, national economy and related industries. Need of cultivation of medicinal and aromatic plants as agricultural crops. Quality concern in plant based drugs. National Medicinal plant development boards. Cultivation techniques of important medicinal plants: Senna, *Gloriosa superba*, *Valeriana jatamansi*, *Swertia chirayita*, *Isabgol*, *Rauwolfia serpentina*, *Withania somnifera*, *Opium Poppy*, *Aloe vera*, *Safavar*, *Stevia rebaudiana*, *Safed Musli*, *Kalmegh* and

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other important aromatic species of the region. Postharvest processing-drying, grading and storage. Essential oils and their quality analysis. Important industries based on non wood forest products and their management.

Practical

Estimation of extractives in a given wood-bark sample; Determination of specific gravity, F.S.P. from shrinkage and sorption; Measurement of thermal conductivity, dielectric constant, permeability of wood to air; Moisture content by oven-drying and distillation methods; Extraction of resins, gums, katha, dyes, tannins, oils raw drugs, bamboos, canes and other products; Estimation of tannins, essential oils in sandalwood, dyes and dyeing trials on different fabrics; Value addition techniques for these products; Visit to non wood forest products based industries. Morphological identification of listed plants and their economic parts, maturity indices; Preparation and layout of nursery and field, methods of seed sowing/ transplantation, cultural operations in MAP crops; Visit to government and private Pharmaceutical units/ Institutes in adjoining areas and MACP; Visit to nearby marketing/ trade centres.

Suggested Reading

Linskens HF and Jackson JF. 1991. Essential Oils and Waxes (Ed.). Springer-Verlag Berlin Heidelberg.

Mathe A. 2015. Medicinal and Aromatic Plants of the World-Scientific, Production, Commercial and Utilization Aspects. Springer Netherlands.

Panda H. 2005. Hand Book on Specialty Gums, Adhesive, Oils, Rosin And Derivatives, Resins, Oleoresins, Katha, Chemicals with others Natural Products. Asia Pacific business press. Inc.

Panshin AJ, Harrer ES and Bethel JS. Forest Products, their Sources, Production and Utilization.

Shackleton S, Shackleton C and Shanley P. 2011. Non-Timber Forest Products in the Global Context (Ed.). Springer, Verlag Berlin Heidelberg.

PAPER IV: POLICY, ACTS AND LEGISLATION IN FORESTRY, WILDLIFE AND ENVIRONMENT

Cr.h (3+1)

Course Objectives:

1. To develop understanding about the forest policies and laws governing forest conservation
2. Awareness on the environmental legislations safeguarding the nature and its components.
3. To develop knowledge on biodiversity acts and forest rights to explore the forest resources.

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Theory

Forest policy -Relevance and scope, National Forest Policy-1804, 1952 and 1988, Chhattisgarh Forest Policy Act 2001, criminal laws, Indian Panel Code, criminal procedure code; Indian Forest Act-1927, Amendments to Indian Forest Act, 1927, Forest Conservation Act 1980, The Forest (Conservation) Amendment Bill, 2023, Biodiversity Act 2002, Forest Rights Act 2006, Privilege concession and Right of forest dwellers, New draft on forest policy 2018, Chhattisgarh Transit (Forest Produce) Rules, 2001, Wildlife Protection Act, 1972, The Wild Life (Protection) Amendment Act, 2022, Environment and their legal issues in India, Legal and policy frameworks related to forest conservation, Environment (protection) act 1986,

Intellectual Property Rights (Patents, Copyrights, Trademark, Trade secrets), freedom of information, and right to know. Important case studies and landmark judgments. Case studies of different forest divisions/ areas of India. International conventions of forestry issue. Role of international treaties like CITES, IUCN, RAMSER, CBD, etc.

Practical

Visit to High Court, Lower Court. Visit to forest depot. Visit and study about crime cell of the forest department, case studies. IPR investigations and understanding the working system. Study on the awareness of International treaties and their uses in the local areas. Database preparation for different offences recorded in the forest.

Suggested Readings

Chaturvedi A.N 2011.*Forest Policy and law*, Khanna Bandhu.

Indian Forest Acts (with short notes) 1975. Allahabad Law Agency.

Jha LK. 1994. *Analysis and Appraisal of India's Forest Policy*. AshishPub!.House.

Poddar A.K. et al. 2011.*Forest Laws and Plicies in India*, Today and Tomarrow Printers and Publishers New Delhi

Prabhakar V.K., 2001. *Laws on Forests* ,Anmol Publication.

National Forest Policy 1952.Ministry of Food and Agriculture, New Delhi.

National Forest Policy 1988.Ministry of Environment and Forests, New Delhi.

Saharia, VB. 1989. *Wildlife Law in India*. Natraj Publ.

Sairam Bhat 2010. Natural Resources Conservation Law, Sage.

Negi SS. 1985. *Forest Law*. Natraj Publ.

Course Outcome:

1. Students will be able to understand about forest and legal rights.

2. Acquainted with the provisions of forest laws and policies.
3. Students understand the biodiversity boards and its working procedures.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	3	1	1	3	3	3	2	1
CO2	3	1	2	3	1	1	3	3	3	2	1
CO3	3	1	2	3	1	1	3	3	3	2	1

Weightage: 1-Sighily; 2-Moderately; 3-Strongly

PAPER V: ENVIRONMENT MANAGEMENT AND SUSTAINABILITY CR.4 (3+1)

Course Objectives:

1. Creating awareness about environmental problems. Developing an attitude of concern for environment.
2. To impart knowledge about the forest functions on global warming and environmental pollutions.
3. To acquire knowledge on national and international treaties, about the international environment conservation policies and agencies engaged in climate change.

Theory

Environment: Definitions and concepts of environment, Environment Pollution: Types, classification and national and international Environmental standards of important pollutants. Air pollution: Major pollutants and their sources. Monitoring of gaseous pollutants and particulate matter. Biological abatement methods. Water Pollution: Important pollutants source, impact of heavy metals. Treatment technologies for industrial effluents/wastewater.

Soil pollution: Heavy metal toxicity in soil, Impact of pesticides, industrial waste and fertilizers on soil. Climate changes and Global Environmental Problems: Causes and impacts, Impact of climate changes on Indian forest. Concept of Adaptability and vulnerability, Bio-manipulation and Bioremediation.

Climate change history, Institutional developments towards climate change. Recent developments in global climate changes, Changes in source and sinks of carbon in the last few decades. Global warming potentials of major GHG's. Effect of climate change on: Ocean, Soil, Forest, Biodiversity. Carbon Footprint: concepts, methods of assessment.

International agreements and policies for earth care, Ramsar Convention, stock home convention, IPCC, Kyoto protocol, COPs, Paris Summit, Montreal Protocol. Conservation policies of The

Ministry of Environment, Forest and Climate change govt. of India, NAPCC, Convention on Biological Diversity (CBD). G20 summit 2023, National Biodiversity Action Plan (NBAP), Nagar Van Udyan Scheme, Swachh Bharat Abhiyan, Green Skill Development Programme, National River Conservation Programme, Green India Mission, and National Afforestation Programme.

Practical

Impact of particulate matter on environment, Impact of coal mining on environment Impact of cement pollution in environment. Effect of effluent from several industries on environment. Reclamation of mining wastes with microorganisms. Bio-accumulation studies on metals by microorganisms. Assessment of environmental impact on polluted sites. Assessing the awareness of environmental regulation and control methods, Impact of power stations on plant, microorganisms, animals and soil, ecosystems, EIA of polluted river ecosystem, Environmental Impact Assessment.

Suggested Readings

Anonymous (2006) .Report of the National Forest Commission. Govt. of India, New Delhi.

E. Claussen, V. A. Cochran, and D. P. Davis. (2001). Climate Change: Science, Strategies, & Solutions, University of Michigan.

Huxley P. (1999). Tropical Agroforestry. Blackwell Science.

Koskela J, Buck A & Teissier du Cros E. (2007). Climate Change and Forest Genetic Diversity: Implications for Sustainable Forest Management in Europe. Biodiversity International; Rome, Italy.

Streck, C et al, (2006). Climate Change and Forests Emerging Policy and Market Opportunities Today & Tomorrow's Printers and Publishers New Delhi.

Course Outcome:

1. Students will be able to analyze and assess the pollutions and their sources.
2. Students understand on the role of forest on pollution control.
3. Students will be able to EIA for various agencies and know about the international and national organizations treaties.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	3	3	3	3	1
CO2	3	3	3	1	3	3	3	3	3	3	3
CO3	3	3	2	3	3	3	3	3	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

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SEMESTER-III

PAPER I. FOREST PROTECTION **Cr.4 (3+1)**

Course Objectives:

1. To identify the degrading agents of forest, pest and diseases.
2. To understand the prevention control measures of diseases associated with trees
3. To learn about integrated pest management techniques for ecofriendly management of forests pandemic.

Theory

General concept of forest protection. Various abiotic and biotic forest damaging agencies. Tree disease concept and disease cycle. Biodegradation of wood - microscopic and chemical effects of white rot, brown rot, soft roi and wood discoloration. Heart rots - factors affecting heart rots, damage caused, compartmentalization of decay in trees and management of heart rots. Role of mycorrhiza in tree health. Important diseases and insects of forest trees- Teak, Sal, Shisham, *Acacia*, *Dalbergia*, Deodar, Pines and *Casuarina*. Biological control of insect pests and diseases of forest trees Nature of disease resistance. Principles and methods of integrated pests management; Insect attractants and repellents. Important insect pests of nurseries, plantations, avenue trees and their management. Insect pests of seeds of forest trees and their management. Forest fire and its impact on overall forest health. Climate change impact on forest fire.Forest fire monitoring systems.

Practical

Collection, identification and preservation of important insect pests and disease specimens of forest plants. Preparation of culture media and methods of inoculation. Vegetative and reproductive study of pathogens. Detection of insect infestation and seed borne mycoflora. Assessment of losses due to diseases, insect pests etc. Fire control methods and devices, Familiarization with the meteorological and plant protection equipment, Application of pesticides and bio- control agents in the management of insect pests, weeds, diseases in nurseries and plantations, Extraction of spores of Vesicular arbuscular mycorrhizal (VAM), fungi from soil and assessment of mycrorrhizal root infection, Preparations of different pesticides; Preparation of fungicidal solutions, In-vitro efficacy and In vivo efficacy assessments.

Suggested Readings

Bakshi BK. 1976. *Forest Pathology*.Controller of Publications, GOI.

Jha LK &SenSarna PK. 1994.*Forest Entomology*.Ashish Publ. House.

S SNegi, 2006. *Handbook of Forest Protection*. International Book Dist., Reprint

Schmidt, Olaf 2006. *Wood and Tree Fungi: Biology Damage Protection and Use*, Today & Tomorrow's Printers and Publishers,New Delhi.

Paul. D. Mennan. 1991. *Tree Diseases Concept.* Prentice Hall.

Stebbings EP. 1977 *Indian Forest Insects.*JKJain Bros.

Course Outcome:

1. Students will be able to identify the pest and diseases of nursery, plantations and forest trees
2. Perform the control measures for different type of pest and disease of the forest species.
3. Students gain how to create healthy and disease free forests.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	1	3	3	3	1
CO2	3	3	1	1	1	1	2	3	3	3	2
CO3	3	3	3	1	1	1	1	3	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER II. WOOD SCIENCE AND TECHNOLOGY CR.4 (3+1)

Course Objectives:

1. To acquaint the students with the wood identification bases on physical, microscopic examination and mechanical characteristics of wood.
2. To have competence on the forest-based industries and product marketing.
3. To acquire knowledge on effective uses of wood of some important trees.

Theory

Wood formation, kinds of wood, wood properties: Physical properties of wood-wood density, specific gravity. Effect of growth on density of wood. Mechanical: Mechanical properties-elastic constants, plasticity, modulus of elasticity, factors affecting strength properties, elastic theory of bending, Thermal properties-conductivity and diffusivity. Electrical properties-conductivity. Wood permeability. Wood moisture and its relationship with strength and wood degradation, Wood seasoning and defects. Wood machining and wood working.

Introduction to wood modification, its need and scope. Wood impregnation, heat stabilization. Modern trends in composite wood. Wood adhesives – types, characteristics and application. Plywood, laminated wood and inorganic wood composites- their manufacture, characteristics and application.

Wood based industries: paper and pulp, match, sport goods, plywood, matchwood industries.

Practical

Determination of wood density, Study of planes of wood, gross features and physical characteristics of important woods; Identification of different types of cells and tissues; Anatomical studies of soft and hard woods, wood bulking, wood moisture, identification of wood samples, wood defects, Effectiveness of wood preservatives, Grading of wood, wood based industries, improved wood and composite wood. Grading of plywood, visit of forest based industries, sawmill, timber marts. Use of different adhesives in plywood; Study of composite boards, study of anti-shrink efficiency of wood treated with different chemicals; Impregnation of wood with chemicals. Study of various wood based industries; Study on raw material requirement and sourcing of plywood, pulp and paper, matchwood, timber processing.

Suggested Reading:

Chauhan Laxmi and Vijendra Rao. 2003. Wood anatomy of Legumes of India: their identification, properties and uses. Bisen Singh and Mahendra Pal Singh, Dehradun.

Eiri Board 2011. Modern Technology of wood, veneer, plywood, particle board, fibre board, bamboo and forest products. Engineers India Research Institute, India

Mehta T. 1981. A hand book of forest utilization. Periodical expert book agency Printer and publisher, New Delhi.

Murthy T.K. 2010.Minor forest products of India. Oxford and IBH Publication, India.

Negi SS. 1997. Wood Science and Technology. International book distributor, Dehradun.

Rao KR and Juneja KBS, 1992. Field identification of 50 important timbers of India, ICFRE Publication, Dehradun, India

Sharma LC. 1977. Development of Forests and forest based industries. Bisen Singh and Mahendra Pal Singh Dehradun, India

Terry Porter 2006. Wood: Identification and use. Guilds of Master Craftsman Publication.

Tewari, D.N. 2008.Management of non-timber forest resource of India. International Book Distributor Company, Lucknow, India

Trotter H. 1992.Manual of Indian forest Utilization. Forest Research Institute, Dehradun.

Tsoumis G. 2009. Science and Technology of Wood. VerlagKessel

Troup RS. 2007. Manual of Indian forest utilization. Today and Tomorrow Printers and Publishers, New Delhi

Course Outcome:

1. Students develop competency in identifying the wood based on their properties and features.
2. The students will develop employability to different forest based industries.
3. Develop knowledge on different grades, preservation techniques, wood working, tools.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1	3	3	3	3	2
CO2	3	3	2	1	1	1	3	3	3	3	2
CO3	3	3	2	1	1	1	3	3	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER III. FOREST ECOLOGY AND BIODIVERSITY CONSERVATION

Cr.4 (3+1)

Course Objectives:

1. To understand the basic concept of ecology its components.
2. Acquire knowledge on biodiversity and its conservation methods
3. To understand the procedures analyzing biodiversity and perform diversity index using advance tools and techniques, ecosystem services and IPR issues

Theory

Introduction to forest ecology, forest population, forest community dynamics, forest community structure and function analysis, forest productivity on a global scale, Hierarchy issues in ecology. Biodiversity-an overview; genetic, species and ecosystem diversity. Higher plant diversity, species richness and endemism. Managing plant genetic resources: Basic science issues – genetic vulnerability, in situ conservation of genetic resources. Basic concept of biodiversity, history of biodiversity conservation, Conservation of natural resources (Hotspot areas, Wildlife Sanctuaries, National parks, Biosphere reserve, Botanical Gardens, Zoological Parks), Important Plant and wildlife ecological indicator species, endangered species, Coral reefs, Mangrove forest. Climate change and biodiversity, Global warming and forests, Green House Effect, Ozone depletion and its consequences, Biodiversity Conservation laws and acts. International programs for biodiversity conservation, Convention on Biological Diversity CBD, CITES UNFCCC Kyoto protocol, FAO and global system of PGR TRIPS agreement and IPR protection of life forms.

Practical

Study of forest community structure and its successional status, Estimation of productivity of forest ecosystem, Study of forest composition, RF, RD, IVI, Shannon diversity index, Use of online diversity

estimation tools, Calculation of Trip to different regions of the state to study forest vegetation, Quantification of litter production and decomposition, Collection and preservation of specimen, identification of ecological indicator species, Methods of vegetation analysis, Measurement of biomass and productivity, Visit to National parks, Wildlife sanctuaries, Botanical gardens and arboreta.

Suggested Readings

Anonymous. 2006. *Report of the National Forest Commission*. Govt. of India.

Kumar Arvind. 2005. *Biodiversity and Conservation*, Today & Tomorrow's Printers and Publishers New Delhi.

Dhyani SN. 1994. *Wildlife Management*, Rawat Publ.

Malik, Ashok. 2008. *Dynamics of Forest Ecosystems*, Today & Tomorrow's Printers and PublishersNew Delhi.

Huxley P. 1999. *Tropical Agroforestry*,Blackwell.

Khan TI &Al-Azmi DN. 1999.*Global Biodiversity Conservation Measures*, Pointer Publ.

Kimmins JP.1976.*Forestry Ecology*, Macmillan.

Nautiyal S &Koul AK. 1999.*Forest Biodiversity and its Conservation Practices in India*, Oriental Enterprises New Delhi .

Ramakrishnan PS. 1992.*Shifting Agriculture and Sustainable Development*.Man and Biosphere Series,The Parthenon Publ.Group.

Singh, M P et al .2013.*Conservation of Biodiversity and Natural Resources*.Today& Tomorrow's Printers and Publishers New Delhi.

Course Outcome:

1. Student will be able to identify different component of ecosystem and its relation with each other.
2. Students will develop competency on forest biodiversity survey and calculation of different indexes
3. Students will know about the different national and international agencies related tofloral and faunal biodiversity conservation.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	3	1	1	2	3	3	3	3	2
CO2	3	1	2	1	1	2	2	3	3	3	2
CO3	3	1	2	1	1	2	1	3	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER IV. INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENT

Cr.4 (3+1)

Theory

Industrial environment: Occupational Health and hazards, safety and health management, hazard identification, risk assessment and control radiation and industrial hazards. Electrical hazards and hazards in Construction Industry, Fire and other Hazards, Safety at Workplace, Material Handling and Storage Plant Design and Housekeeping, Industrial Lighting, Vibration and Noise, Accident Prevention Techniques, Introduction to environment impact analysis, Environmental impact statement and Environmental management plan, ISO14000, EIA guidelines 1994, Notification of Govt. of India. Guidelines for Environmental Audit, Baseline information and prediction (land, water, atmosphere, energy).

Biotransformation, bioconversion, bioremediation, phytoremediation technology, fermentation technology, development of stress tolerant plants, Environmental problems & Environmental monitoring through microorganism, microbiology of water, air and soil, microbes as pathological agent in plant, animal and man. Risk analysis - definition of risk, Environmental risk analysis.

Practical-

Preparation of a safety inspection check list in industry, Visit to different types of industry - Identification of different types of hazards in industry (Plant training of 3 weeks is compulsory and a report to be submitted to the department with due certification of the industry where training is done), Case study of environmental audit to different industries. Methodological approaches and tools for key stages in the process: Screening (classification of developments and stage to determine the level of EIA, Exclusion and inclusion lists of projects, different approaches to screening) Impact prediction and evaluation (approach for baseline development and methods of impact identification-checklists, Matrices, Networks), EIA of development projects, EIA of restored mine lands, Undertaking an EIA, case studies for agro- industries.

Suggested readings

Botkin and Keller. (2012). 'Environmental Science, John Wiley & Sons Inc., Wiley India (P) Ltd., New Delhi. Eighth Edition.

Krishnamoorthy, B. (2009). Environment Management -Text and Practices, New Delhi: Prentice Hall India. www.prenticehall.india.org second edition

Rajgopalan R., (2016). 'Environmental Studies - from crisis to cure', Oxford University press, New Delhi. Third Edition.

Santra S.C., (2014). 'Environmental Science', New Central Book Agency Pvt. Ltd, Kolkata. Third Edition.

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Krishnamoorthy, B. (2009). Environment Management -Text and Practices, New• Delhi: Prentice Hall India. www.prenticehall.india.org third edition

Karpagam M. and Jaikumar G. (2010), 'Green Management – Theory and Applications' Anc Books Pvt. Ltd. New Delhi.

Masahan, S.E. (1997). Environmental Science and Technology. Lewis, New York.

Metcalf and Eddy (Eds). (2003), Wastewater Engineering: Treatment and Reuse, Tata McGraw-Hill, New Delhi.

Thomas, J.A. and Fuchs, R. 2002. Biotechnology and Safety Assessment. Academic Press.

Wang L.K. Hung Y.T. nad Shammas N.K.(Eds). 2006. Advanced Physicochemical Treatment Processes. Springer-Verlag New York, LLC.

Course Outcome:

1. Student knowledge of the industrial environment, safety, and health management.
2. To know how to work on an environmental impact statement and environmental management plan.
3. Students will be expertise in different statistical packages used for industrial risk data analysis

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	1	1	3	3	3	2
CO2	2	3	1	1	1	1	1	3	3	3	1
CO3	2	3	1	1	1	1	1	3	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER V. FOREST AND PEOPLE CR.4 (3+1)

Course Objectives:

1. To develop understanding on the sustainability components for forest resources management practices.
2. To aware students won the people participation and community for forest conservation and natural resource management programs.
3. To shape out students for participatory management practices with local community for protecting biodiversity and livelihood.

Theory

Interactions between forests and people, socio economic and cultural importance of forests and significance of forest in rural development and employment generation. Forest societies, Forest rights of people. Management of Common Property Resources (CPRs) and open access resources, The role

of indigenous and local communities on forest management and sustainable livelihood strategies. Sustainable Forest Management-concept and principles, Criteria and Indicators of Sustainable Forest Management.

Micro-level planning and participatory rural appraisal. Techniques of PRA and RRA. Role of NGOs and other community-based organizations in forest management. Gender dimension on forest management. Ecotourism: sustainable tourism and people's participation. People's movement in forest conservation. Forest conflicts, Forestry extension. Biodiversity and ethnobotany, Joint Forest Management and SFM in protected forest area, Wildlife and human conflicts, Community participation in wildlife management.

Global environmental challenges and issues, Carbon credit, CIFOR, REDD, REDD+ Payments for environmental services. National strategies and action plans for SFM, CAMPA, JFM, Assistant Natural Regeneration, National Green Tribunal. International forestry Universities and institutions. National and international fellowships, memberships.

Practical:

Practice of Participatory Rural Appraisal technique. Preparation of micro plan for sustainable forest management. Resource survey and preparation of resource map. Exercise on designing training program for sustainable forest management. How to prepare leaflets and pamphlets. Filed visit to ecotourism sites.

Suggested Readings:

Anonymous .2006.Report of the National Forest Commission. Govt. of India, New Delhi.

E. Claussen, V. A. Cochran, and D. P. Davis. 2001. Climate Change: Science, Strategies, & Solutions, University of Michigan.

Huxley P. 1999. Tropical Agroforestry. Blackwell Science.

Koskela J, Buck A &Teissier du Cros E. 2007.Climate Change and Forest Genetic Diversity: Implications for Sustainable Forest Management in Europe. Biodiversity International; Rome, Italy.

Strategies and Solutions. Pew Centre on Global Climate Change, USA.

Streck, C et al, 2006 Climate Change and Forests Emerging Policy and Market Opportunities Today & Tomorrow's Printers and Publishers New Delhi.

Annamalai R. 1999. Participatory Learning Action and Microplanning for JFM. Dean SFRC, Coimbatore. FAO 1978.

Forestry for Local Community Development. FAO Publ. Shah SA. 1988.

Forestry for People. ICAR. Tiwari KM. 1988.

Social Forestry and Rural Development. International Book Distr. Vyas GPD. 1999. Community Forestry.

Course Outcomes:

1. Students will be able to understand the sustainability concept of forest for its management.
2. The learner will learn the role of people participation and community for the successful implementation of government schemes in forest.
3. The students will understand about different organizations, NGOs engaged in forest conservation and rejuvenation.

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	3	3	3	3	1
CO2	3	3	3	1	3	3	3	3	3	3	3
CO3	3	3	2	3	3	3	3	3	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEMESTER IV

PAPER I. FOREST STATISTICS & RESEARCH METHODOLOGY CR.4 (3+1)

Course Objectives:

1. To learn about bio statistics, experimental designs for the forest based experiment
2. To develop understanding of the data handing, tabulation and graphical representation
3. To learn the uses of different statistical software.

Theory

Basics of statistics: Scales of measurement, types of data: quantitative and qualitative data of forest tree species frequency arrangement, different series and its arrangement and representation methods, Central tendency: Mean, Median, Mode, Measures of Dispersion: Range, quartile deviation, Mean deviation and Standard deviation- variance, covariance, Basic concept of probability, Correlation: Concept, Karl Pearson's coefficient, Spearman rank correlation coefficient, Regression: Regression equations, linear and nonlinear regressions and regression coefficient. Tests of significance: t- test, paired t-test, Z- test and χ^2 –test

Analysis of Variance (ANOVA) - one way and two way analysis of variance, Experiments designs:

Basic concept, Principles of experimental designs, Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD), Split Plot and Strip Plot Designs, Comparisons of all experimental designs, SPSS, PAST and other online tools of statistical analysis.

Practical

Use of Excel sheet: To arrange forest based statistical data and represent in different diagram and graphical ways, Forest based measurements: arrangements and frequency distribution, Calculation of mean, median and mode of measured characteristics of different tree species, Finding out the relationship between the height and DBH of some forest tree species-correlations and regressions, Testing the hypothesis under t- test, z- test and χ^2-test,

ANOVA under the different types of designs: Completely Randomized Block Design, Randomized Block Design, Latin Square Design, application of SPSS, PAST and other online tools for statistical analysis

Suggested Readings

Forestry Statistics India-1996: Indian Council of Forestry Research and Education, 1999

Mead R & Relay J. 1987. *Statistical Tools for Agro-Forestry Research - Bivariate Analysis for intercropping Experiments*. ICRAF, Nairobi.

Surendran C, Sehgal RN &Paramathma M. *Statistical Methods for Agricultural Workers*.ICAR.2003.

R. Rangaswamy: A Text Book of Agricultural Statistics, New Age International Pvt Ltd Publisher, ISBN-9788122425925, 9788122425925

Dr. S R S Chandel: A handbook of Agricultural Statistics, IMPECT PUBLISHER

Course Outcome:

4. Student knowledge on the layout experimental designs.
5. Develop competency for data handling, graphical designing and test of experimental data statistically.
6. Students will be expertise on different statistical packages used for data analysis

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	1	1	3	3	3	2
CO2	2	3	1	1	1	1	1	3	3	3	1
CO3	2	3	1	1	1	1	1	3	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PAPER II: DISSERTATION **CR: 20**

Course Objective

1. To provide an opportunity to unearth new information related to specific topics of forestry and motivate students to pursue further research.
2. To equip students for conducting research, writing of research reports on forestry related problems.
3. To educate students on recent advances in forestry research and management practices.

Contents:

Student must conduct a Research project based on some topics related to forestry which will be submitted as a Dissertation. The Dissertation will be evaluated by the external examiner based on presentation, subject knowledge and dissertation report and quality.

Course outcomes

CO1: Students will have the skill to carry out a minor research work and develop scientific writing skills.

CO2: Students will be capable to perform data analysis by using various statistical tools.

Course Outcomes and their mapping with Program Outcomes:

CO	PO								PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	3	3	3	2
CO2	3	3	3	3	2	3	3	3	3	3	2

Weightage:1-Sightly;2-Moderately;3-Strongly

Examination marking system

Each course will be evaluated as followings:

Sub Code	L	T	P	Duration	IA	ESE (T)	ESE (P)	Total	Credits
	3	-	1	5 hours	30	70	100	200	4

- **Summer internship**: Students will be attached to forest to learn various forest operations, forest based industries and or forest institutes as per their interest. However, he has to present certificate of internship and will make a presentation/ seminar. Internship will of non-credit. The evaluation/ validation of internship will be done by external examiner/ internal examiner/HOD, etc. based on student seminar/ presentation.
- **Dissertation**: The dissertation topic will be allotted to the student in III Semester while it will be evaluated at the end ofIV Semester. Students will choose research topic on his own interest on forestry topics related to the curriculum under the guidance of students Mentor/ supervisor.

- Student must conduct a Research project based on some topics related to forestry which will be submitted in the form of Dissertation. The Dissertation will be evaluated by the external examiners appointed by the competent authority of the University. Based on student presentation, subject knowledge and dissertation report and quality, the mark will be evaluated out of 200 marks (**Presentation 50 marks, subject knowledge 50 marks, Dissertation quality, content, statistics, graphic and figures 100 marks**).
- Two mid-term exams of 15 marks each (total 15+15=30) will be conducted considering summative or formative methods. End semester exam marks will be held of total 70 marks.

3.7.2023

Department **: *Forestry ,Wildlife and Environmental Sciences***

Programme Name **: *M.Sc.***

Academic Year **: *2023-24***

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

01.	FOPATT1	Advances in Silviculture
02.	FOPALT1	Advances in Silviculture
03.	FOPATT2	Forest Biotechnology & Tree Improvement
04.	FOPALT2	Forest Biotechnology & Tree Improvement
05.	FOPATT3	Forest Biometry, Surveying & Engineering
06.	FOPALT3	Forest Biometry, Surveying & Engineering
07.	FOPATT4	Forest Soil and Watershed Management
08.	FOPALT4	Forest Soil and Watershed Management
09.	FOPATT5	Wildlife Management and Conversation
07.	FOPALT5	Wildlife Management and Conversation
08.	FOPBTT1	Forest Management, Remote Sensing & GIS
10.	FOPBLT1	Forest Management, Remote Sensing & GIS
11.	FOPBTT2	Agro-forestry and Farm Forestry
12.	FOPBLT2	Agro-forestry and Farm Forestry
13.	FOPBTT3	Forest Product & Utilization
14.	FOPBLT3	Forest Product & Utilization
15.	FOPBTT4	Policy Acts and Legislation in Forestry, Wildlife and Environment
16.	FOPBLT4	Policy Acts and Legislation in Forestry, Wildlife and Environment
17.	FOPBTT5	Environment Management and Sustainability

18.	FOPBLT5	Environment Management and Sustainability
19.	FOPCTT1	Forest Protection
20.	FOPCLT1	Forest Protection
21.	FOPCTT2	Wood Science and Technology
22.	FOPCLT2	Wood Science and Technology
23.	FOPCTT3	Forest Ecology and Biodiversity Conservation
24.	FOPCLT3	Forest Ecology and Biodiversity Conservation
25.	FOPCTT4	Industrial Safety, Health and Environment
26.	FOPCLT4	Industrial Safety, Health and Environment
27.	FOPCTT5	Forest and People
28.	FOPCLT5	Forest and People
29.	FOPDTT1	Forest Statistics and Research Methodology
30.	FOPDLT1	Forest Statistics and Research Methodology
31.	FOPDPJ1	Dissertation

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2023-24

School : *School of Natural Science*

Department : Forestry, Wildlife & Environmental Sciences

Date and Time : 03.07.2023 at 11:30 am

Venue : Smart classroom

The scheduled meeting of members of the Board of Studies (BoS) of the Department of Forestry, Wildlife, and Environmental Sciences School of Studies of Natural Resources, Guru Ghasidas Vishwavidyalaya, Bilaspur was held on dated 03.07.2023 at 11:30 am in smart classroom to discuss and design the syllabus of B. Sc. (Forestry) 4 Years (8 semester) scheme as per NEP 2020 guidelines, M.Sc. Forestry and Environmental Sciences and Ph. D. course work curriculum and credit framework/ syllabus as per LOCF guidelines. External Expert has joined the meeting through online mode. The following members of BOS were present in the meeting:-

The following members were present in the meeting:

1. Prof. Manmohan Dobriyal (External Expert Member BoS, Rani Laxmi Bai Central Agricultural University, Jhansi.)
3. Prof. K. K. Chandra (HOD, Associate Prof., Dept. of Forestry, Wildlife and Environmental Sciences.-cum Chairman, BOS)
4. Prof. S.C. Tiwari (Member BoS, Associate Professor, Dept. of Forestry, Wildlife and Environmental Sciences)
5. Prof. S. S. Dhuria (Member, Associate Professor, Dept. of Forestry, Wildlife and Environmental Sciences)
6. Dr. Bhavana Dixit (Member, Assistant Professor, Dept. of Forestry, Wildlife and Environmental Sciences)