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.*

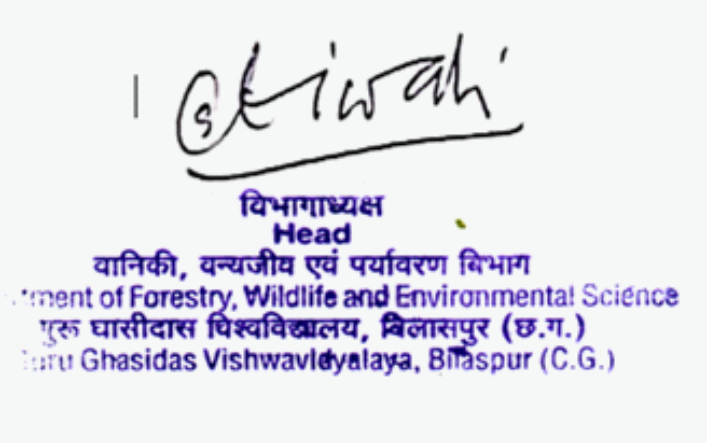
Academic Year : 2024-25

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Sr. No.	Course Code	Name of the Course
01.	UFOAMJT1	Silviculture
02.	UFOAMJP1	Silviculture
03.	UFOBMJT1	Fundamentals of Soil Science
04.	UFOBMJT1	Fundamentals of Soil Science
05.	UFOCMJT1	Forest Biometry
06.	UFOCMJT1	Forest Biometry
07.	UFOCMJT2	Forest Genetics and Tree Improvement
08.	UFOCMJT2	Forest Genetics and Tree Improvement
09.	UFODMJT1	Tree Seed and Nursery Technology
10.	UFODMJT1	Tree Seed and Nursery Technology
11.	UFODMJT2	Forest Management
12.	UFODMJT2	Forest Management
13.	UFODMJT3	Forest Ecology and Ecosystem Analysis
14.	UFODMJP3	Forest Ecology and Ecosystem Analysis
15.		Attachment to Industries/Institutions/Villages
16.	UFOEMJT1	Application of RS & GIS in Natural Resources Management
17.	UFOEMJP1	Application of RS & GIS in Natural Resources Management
18.	UFOEMJT2	Wood Science and Technology

16.	UFOEMJP2	Wood Science and Technology
17.	UFOEMJT3	Forest Resource Economics & Management
18.	UFOEMJP3	Forest Resource Economics & Management
19.	UFOFMJT1	Forest Protection
20.	UFOFMJP1	Forest Protection
21.	UFOEMJT2	Agroforestry and Tree Outside Forests
22.	UFOFMJP2	Agroforestry and Tree Outside Forests
23.	UFOFMJT3	Forest Products and utilization
24.	UFOFMJP3	Forest Products and utilization
25.	UFOGMOC1	Wildlife and its conservation /MOOC
26.	UFOBMDT1	Introduction to Indian wildlife
27.	UFOGMJT1	World Forestry, Urban Forestry and Community Forestry
28.	UFOGMJP1	World Forestry, Urban Forestry and Community Forestry
29.	UFOGMJT2	Forest Policies, Acts and Legislation
31.	UFOGMJP2	Forest Policies, Acts and Legislation
32.	UFOHMJT1	Biostatistics and Research Methodology
33.	UFOHMJP1	Biostatistics and Research Methodology
34.	UFOHRPDSSS1	Research Project/Dissertation
35.	UFOBSCT1	Wildlife Biology
36.	UFOBSCP1	Wildlife Biology
37.	UFOHMJT2	Forest based Entrepreneurship Development
38.	UFOHMJP2	Forest based Entrepreneurship Development
39.	UFOGSMNR	Seminar(Compulsory)
40.	UFOAMNT1	Introduction to Wildlife
41.	UFOAMNP1	Introduction to Wildlife
42.	UFOBVCT1	Nursery and Plantation Technology
43.	UFOBVCP1	Nursery and Plantation Technology
44.	UFOEMNT1	Earth Care Policy

45.	UFOAMNP1	Earth Care Policy
46.	UFOGMNT1	Value Addition of NTFP
47.	UFOGMNP1	Value Addition of NTFP
48.	UFOFMNT1	Commercial Nursery Production
49.	UFOFMNP1	Commercial Nursery Production
50.	UFODVCT1	Industrial Plantation
51.	UFODVCP1	Industrial Plantation
52.	UFOCVCT1	Environmental Audit
53.	UFOCVCP1	Environmental Audit
54.	UFOGMNT1	Urban Forestry and Designing
55.	UFOGMNP1	Urban Forestry and Designing
56.	UFOGMNT2	Ecotourism
57.	UFOGMNP2	Ecotourism
58.	UFOAMDT1	Know Your Forest
59.	UFOASCT1	Nursery Technology
60.	UFOASCP1	Nursery Technology
61.	UFOVACT1	Environmental Education
62.	UFOCMDT1	Plantation Forestry
63.	UFOCSCT1	Afforestation Techniques
64.	UFOCSCP1	Afforestation Techniques



List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

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

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

Academic Year **: *2024-25***

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

01.	PGFOAT1	Advances in Silviculture
02.	PGFOAP1	Advances in Silviculture
03.	PGFOAT2	Forest Management
04.	PGFOAP2	Forest Management
18.	PGFOAT3	Forest Biometry, Surveying & Engineering
19.	PGFOAP3	Forest Biometry, Surveying & Engineering
20.	PGFOAT4	Forest Soil and Watershed Management
21.	PGFOAP4	Forest Soil and Watershed Management
22.	PGFOAOT	Essentials of Environmental Sciences
23.	PGFOAOP	Essentials of Environmental Sciences
24.	PGFOBT1	Remote Sensing and GIS
25.	PGFOBP1	Remote Sensing and GIS
26.	PGFOBT2	Advances in Agroforestry
27.	PGFOBP2	Advances in Agroforestry
28.	PGFOBT3	Forest Products & Utilization
29.	PGFOBP3	Forest Products & Utilization
30.	PGFOBT4	Climate Smart Forestry and Forest Policy

31.	PGFOBP4	Climate Smart Forestry and Forest Policy
32.	PGFOBTS	Wildlife and its Conservation/MOOCS
33.	PGFOBPS	Wildlife and its Conservation/MOOCS
34.	PGFOBT6	Forest Genetics and Tree improvement
35.	PGFOBP	Forest Genetics and Tree improvement
36.	PGINTBI	Summer Internship (Two weeks)
37.	PGFOCT1	Wood Science and Technology
38.	PGFOCP1	Wood Science and Technology
39.	PGFOCT2	Forest Protection
40.	PGFOCP2	Forest Protection
41.	PGFOCT3	Forest Ecology and Biodiversity Conservation
42.	PGFOCP3	Forest Ecology and Biodiversity Conservation
43.	PGFOCT4	Industrial Safety, EIA and Environmental audit
44.	PGFOCTS	Industrial Safety, EIA and Environmental audit
45.	PGFOCTS	Forest Statistics and Research Methodology
46.	PGFOCPS	Forest Statistics and Research Methodology
47.	PGFODD1	Dissertation

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

Academic Year	**: 2024-25**
School	**: Natural Resources**
Department	**: Forestry, Wildlife and Environmental Sciences**
Date and Time	**: July 19, 2025 11:00 am**
Venue	**: HOD room**

The scheduled meeting of member of Board of Studies (BoS) of Department Forestry, Wildlife and Environmental Sciences, School of Studies of Natural Resources, Guru Ghasidas Vishwavidyalaya, Bilaspur was held on dated 19.06.2025 at 11:00 am in HOD room to design and discuss the and design the syllabus of B. Sc. (Forestry) 4 Years (8 semester) scheme as per NEP 2020 guidelines, M.Sc. Forestry and Environmental Sciences curriculum and credit framework/ syllabus as per CBCS guidelines. External Expert has joined the meeting through online mode.

The following members were present in the meeting:

1. Prof. Sanjeev Kumar, External Expert Member, Dean, College of Forestry, Banda University Agricultural and Techology, Banda (UP)
2. Shri Pankaj Sharma, External expert, DGM, Environment Management, NTPC, Sipat, Bilaspur
3. Prof. Dr. S.C. Tiwari, Dean, HoD, Chairperson, BoS, Dept. Forestry, Wildlife and Environmental Sciences
4. Prof. S. S. Dhuria, Member of BOS, Dept. Forestry, Wildlife and Environmental Sciences,
5. Prof. K. K. Chandra, Member of BOS, Dept. Forestry, Wildlife and Environmental Sciences,
6. Dr. Ajay Kumar Singh, Member, BoS, Assistant Professor, Dept. Forestry, Wildlife and Environmental Sciences

Following points were discussed during the meeting

1. Revised ordinance of B. Sc. (Forestry) Four Years (8 Semester) degree program.
2. The BoS has approved the NEP2020 Course curriculum and ordinance of B. Sc. (Forestry) Four Years (8 Semester) degree program with effect from academic session 2024-25.
3. The BoS has approved the NEP2020 Course curriculum and CBCS ordinance of M. Sc. (Forestry) Two Years (4 Semester) degree program with effect from academic session 2025-26.

Head

Scheme and Syllabus

Curriculum and Credit Framework- NEP 2020

FOR

B.Sc. FORESTRY

(w.e.f. Academic session:2025-26)

"SCHOOL OF STUDIES 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

19/06/2025

19/06/2025

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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	UFOAMJT1	Silviculture	3	3	100
	Major-01 Practical	UFOAMJP1	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	UFOBMJT1	Fundamentals of Soil Science	3	3	100
	Major -02 Practical	UFOBMJP1	Fundamentals of Soil Science	1	2	100
	VOC -01		Drawn From the University pool	1	1	100
	VOC -01 Practical			3	6	100
	Multidisciplinary-02		Drawn From the University pool	3	3	100
	Ability Enhancement Compulsory (AEC-02)		Drawn from the university pool	2	2	100
	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

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Attested
10/07/2025

	TOTAL	20	24	900
	Summer Internship for two weeks (Compulsory for 1 Year Certificate course)	4		100

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
III	Major -03	UFOCMJT1	Forest Mensuration	3	3	100
	Major -03 Practical	UFOCMJP1	Forest Mensuration	1	2	100
	Major -04	UFOCMJT2	Forest Genetics and Tree Improvement	3	3	100
	Major -04 Practical	UFOCMJP2	Forest Genetics and Tree Improvement	1	2	100
	VOC -02		Drawn From the University pool	1	1	100
	VOC -02 Practical			3	6	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	25	900
IV	Major -05	UFODMJT1	Tree Seed and Nursery Technology	4	4	100
	Major -05 Practical	UFODMJP1	Tree Seed and Nursery Technology	1	2	100
	Major -06	UFODMJT2	Forest Management	4	4	100
	Major -06 Practical	UFODMJP2	Forest Management	1	2	100
	Major -07	UFODMJT3	Forest Ecology and Ecosystem Analysis	3	3	100
	Major -07 Practical	UFODMJP3	Forest Ecology and Ecosystem Analysis	1	2	100
	VOC -03		Drawn From the University Pool	1	1	100
	VOC -03 Practical			3	6	100

	Ability Enhancement Course (AEC-04)		Drawn From the University Pool	2	2	100
	Total			**20**	**26**	**900**
	Summer Internship (Compulsory for 2 Year Diploma course)			4		100
V	Major -08	UFOEMJT1	Application of RS & GIS in Natural Resource Management	4	4	100
	Major -08 Practical	UFOEMJP1	Application of RS & GIS in Natural Resource Management	1	2	100
	Major -09	UFOEMJT2	Wood Science and Technology	4	4	100
	Major -09 Practical	UFOEMJP2	Wood Science and Technology	1	2	100
	Major -10	UFOEMJT3	Forest Resource Economics & Management	4	4	100
	Major -10 Practical	UFOEMJP3	Forest Resource Economics & Management	1	2	100
	Minor- 02		Drawn From the University pool	3	3	100
	Minor - 02 Practical			1	2	100
	Winter Internship	UFOEINT1	Compulsory for the two weeks	2	-	100
	Total			**21**	**23+**	**900**
VI	Major -11	UFOFMJT1	Forest Pathology and Entomology	4	4	100
	Major -11 Practical	UFOFMJP1	Forest Pathology and Entomology	1	2	100
	Major -12	UFOEMJT2	Agroforestry Management	4	4	100
	Major -12 Practical	UFOFMJP2	Agroforestry Management	1	2	100
	Major -13	UFOFMJT3	Forest Products and utilization	4	4	100
	Major -13 Practical	UFOFMJP3	Forest Products and utilization	1	2	100
	Minor- 03		Drawn From the University pool	3	3	100
	Minor- 03 Practical			1	2	100

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	TOTAL			**19**	**23**	**800**
VII	Major -14	UFOGMJT1	World Forestry and Community Development	4	4	100
	Major -14 Practical	UFOGMJP1	World Forestry and Community Development	1	2	100
	Major -15	UFOGMJT2	Forest Policies, Acts and Legislation	4	4	100
	Major -15 Practical	UFOGMJP2	Forest Policies, Acts and Legislation	1	2	100
	MOOC -1	UFOGMOC1	Wildlife and its conservation /MOOC	4	4	100
	Minor- 04		Drawn From the University pool	3	3	100
	Minor- 04 Practical			1	2	100
	Seminar	UFOGSMNR	**Seminar (Compulsory)**	1	4	
	TOTAL			**19**	**25**	**700**
VIII (4 Year Honours course)	Major -16	UFOHMJT1	Biostatistics and Research Methodology	4	4	100
	Major -16 Practical	UFOHMJP1	Biostatistics and Research Methodology	1	2	100
	Major -17	UFOHMJT2	Forest based Entrepreneurship Development	4	4	100
	Major -17 Practical	UFOHMJP2	Forest based Entrepreneurship Development	1	2	100
	Minor- 05		Drawn From the University pool	3	3	100
	Minor- 05 Practical			1	2	100
	Minor- 06		Drawn From the University pool	3	3	100
	Minor- 06 Practical			1	2	100
	Seminar		Seminar	3	3	100
			Total	**21**		**900**

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VIII (4 Year Honours with Research)	Major -16	UFOHMJT1	Biostatistics and Research Methodology	4	4	100
	Major -16 Practical	UFOHMJP1	Biostatistics and Research Methodology	1	2	100
	Minor- 05		Drawn From the University pool	3	3	100
	Minor- 05 Practical			1	2	100
	Research Project/Dissertation	UFOHRPDSSS1	Research Project/Dissertation	12	-	100
			Total	**21**		**500**
GRAND TOTAL CREDITS				**160**		

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Minor Courses offered by Department of Forestry Wildlife and Environmental Sciences

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
I	MINOR-1	UFOAMNT1	Introduction to Wildlife	3	5	100
	MINOR-1 (Practical)	UFOAMNP1	Introduction to Wildlife	1		100
V	MINOR-2	UFOEMNT1	Earth Care Policy	3	5	100
	MINOR-2 (Practical)	UFOEMNP1	Earth Care Policy	1		100
VI	MINOR-3	UFOFMNT1	Commercial Nursery Production	3	5	100
	MINOR-3 (Practical)	UFOFMNP1	Commercial Nursery Production	1		100
VII	MINOR-4	UFOGMNT1	Value addition of NTFP	3	5	100
	MINOR-4 (Practical)	UFOGMNP1	Value addition of NTFP	1		100
VIII	MINOR-5	UFOHMNT1	Urban Forestry and Designing	3	5	100
	MINOR-5 (Practical)	UFOHMNP1	Urban Forestry and Designing	1		100
	MINOR-6	UFOHMNT2	Ecotourism	3	5	100
	MINOR-6 (Practical)	UFOHMNP2	Ecotourism	1		100

Vocational Courses offered by Department of Forestry Wildlife and Environmental Sciences

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
II	VOC -1	UFOBVCT1	Nursery and Plantation Technology	1	1	100
	VOC-1 (Practical)	UFOBVCP1	Nursery and Plantation Technology	3	6	100
III	VOC – 2	UFOCVCT1	Environmental audit	1	1	100
	VOC-2 (Practical)	UFOCVCP1	Environmental audit	3	6	100
IV	VOC-3	UFODVCT1	Industrial Plantation	1	1	100
	VOC-3 (Practical)	UFODVCP1	Industrial Plantation	3	6	100

Multidisciplinary Courses offered by Department of Forestry Wildlife and Environmental Sciences

Semester	Course	Course Code	Name of the course	Credit	Hour/week	Marks
I	MULT-01	UFOAMDT1	Know Your Forest	3	3	100
II	MULT-02	UFOBMDT1	Introduction to Indian wildlife	3	3	100
III	MULT-03	UFOCMDT1	Plantation Forestry	3	3	100

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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
I	SEC-01	UFOASCT1	Nursery Technology	2	4	100
	SEC-01 (Practical)	UFOASCP1	Nursery Technology	1		100
II	SEC-02	UFOBSCT1	Wildlife Biology	2	4	100
	SEC-02 (Practical)	UFOBSCP1	Wildlife Biology	1		100
III	SEC-03	UFOCSCT1	Afforestation Techniques	2	4	100
	SEC-03 (Practical)	UFOCSCP1	Afforestation Techniques	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/II	VAC-01	UFOVACT1	Environmental Education	2	2	100
As per university instruction environmental education subject will be taught to the different student of the university.						

MOOC Course offered by the different online platform.

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
VII	MOOC	UFOGMOC1	Wildlife and its Conservation /MOOC	4	4	100
As per university instruction online/offline MOOC subject will be taught to the student if not available on online platform.						

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 which 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 to 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.

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PO3. Application of modern tool and techniques: Select, learn and apply appropriate techniques, resources, sophisticated instruments, RS and GIS for explaining different forestry operational activities, wildlife management and environmental impact assessment.

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, forest-based 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.

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SEMESTER – I

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

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOAMJT1 UFOAMJP1	3	-	1	5 hours	30	70	30	70	200	4

Course Objectives:

1. This course will make an introduction of students with silviculture.
2. To provide knowledge about various forest types silvicultural practices and influences of locality factor on forest
3. To provide knowledge about forest regeneration, natural and artificial and Forest nursery development
4. The subject provides information related to cultural operations like tending operation, pruning, climber cutting etc.
5. To provide information about silvics of some important tree species.

Theory

Unit 1: Definition, objectives and scope of silviculture, status of forest cover of India. Forest tree identification.

Unit 2: Locality factors influencing forest growth and distribution in India. Major forest types of India –forest, composition and structure.

Unit 3: Seed collection, science of storage & testing. Natural and Artificial regeneration. Nursery techniques.

Unit 4: Silvicultural operations and their significance in Forestry.

Unit 5: Silvics of important forest tree species- *Cedrus deodara, Pinus roxburghii, Shorea robusta, Tectona grandis, Terminalia species, Dalbergia species, Bamboo species*

Practical

Study of composition of nearby forest areas to know the different species, Phenological study of some important tree species, Seed identification and sowing methods. Regeneration survey, Application of 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.

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4. Negi, S.S. (1983). General Silviculture, Bisen Singh Mahendra Pal Singh, 23 A Connaught Place Dehradun.

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 9789391411836

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 / composition.

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

CO4: Student will learn the growth and life history of tree species.

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
CO5	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

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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 (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOBMJT1 UFOBMJP1	3	-	1	5 hours	30	70	30	70	200	4

Objectives:

1. To provide practical knowledge about soil, its 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 students in soil testing and site evaluation for establishing forest plantation.
5. To import knowledge on comprehensive soil physic-chemical properties.

Theory

Unit 1: Concepts of soil and soil science, Composition of Earth crust, Classification- soil forming minerals- definition, classification-silicates, oxides, carbonates, sulphides, phosphates-occurrence.

Unit 2: Weathering of rocks and minerals, weathering factors, Types of weathering- Physical weathering-agents of Physical weathering and their role, Chemical weathering- Solution, hydration, hydrolysis, carbonation, oxidation and reduction, biological agents involved.

Unit 3: Soil formation, Factors of Soil Formation, Soil classification, Soils of India, Soil profile, Forest soils – distinguishing features; soil physical, chemical and biological properties.

Unit 4: Soil fertility, Essential plant nutrients, Soil organic matter; decomposition, nutrient cycling, Mineral Transformation-Carbon cycle, Nitrogen cycle, Phosphorous cycle, Sulphur cycle, Fertilizers, Bio-fertilizers.

Unit 5: Plant-Soil-Microbes interactions, Mycorrhizal associations, Nitrogen fixation, soil degradation, management interventions of forest soils.

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Practical

Study on soil profile. Soil Collection and Processing techniques. Determination 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. Das, D.K (2013) Introductory Soil Science. Kalyani publishers.
2. Armson, K.A. Forest Soils, (1977). IBD Publisher, Dehradun.
3. Biswas, T.D. and S.K. Mukherjee (2001). Text book of soil Science. Tata Mc. Grew Hill, Publishing Co., New Delhi.
4. Brady, N. Cand Weil, R.R. (2009). Nature and properties of Soil. Prentice Hall of India.
5. Gaurav, Shalendra Singh (2015), Soil Science, DBS Imprints.
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. J.W. Doran and A.J. Jones (1996). Methods of Assessing Soil Quality. Soil Science Society of America, Madison.
10. Plaster, Edward J., (2014). Soil Science and Management. Delmar Cengage Learning.

Course Outcomes:

CO1: Student's will learn about the soil forming minerals and weathering process in soil formation.

CO2: Student's will be able to differentiate between different soil types, its components and properties with relation to vegetation growth.

CO3: Students will be enhancing the knowledge about soil characteristics, soil –water relationships, soil fertility of different forest and its interaction with each other.

CO4: Graduates will understand the dynamics of soil nutrients and its relation with plants.

CO5: 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	2	3	3	3	-	3	3	2	2	2	2
CO5	3	2	3	3	3	-	3	3	2	2	2	2

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

PAPER-II: VOC PAPER **(VOC-01)** **CR: 1+3**

Drawn from the University pool

PAPER-III. MULTIDISCIPLINARY **(MDC-02)** **CR: 3**

Drawn from the University pool

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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

SUMMER INTERNSHIP CR: 4

SEMESTER – III

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

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOCMJT1 UFOCMJP1	3	-	1	5 hours	30	70	30	70	200	4

Course Objectives:

1. To acquaint students about tree/forest measurements and increment.
2. To develop skills for estimating the growing stock, volume, and age of the trees.
3. To understand the different methods and recent techniques of forest inventory.
4. To have the basic knowledge on forest surveying tools and techniques.
5. To know engineering aspects of forest building, road and bridge constructions.

Theory

Unit 1: Measurement of tree parameters: girth, diameter, height and form factor. Estimation of volume, growth and yield of individual tree and forest stands.

Unit 2: Stump analysis and stem analysis for determining past growth. Preparation of volume table, yield table, stand table & its application in forestry

Unit 3: Forest inventory, sampling methods adopted in forestry. Growth and yield prediction models – their preparation and applications.

Unit 4: Basic survey tools of forestry: Chain survey, plane table and compass survey.

Unit 5: Forest Engineering: Building materials, forest roads, culverts and bridges.

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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. 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 in forest areas.

Suggested Readings

1. Chaturvedi A N and Khanna L S. 1994. Forest Mensuration. International Book Distributor, Dehradun, India
2. Masani, NJ. 1995. Forest Engineering without tears, Natraj Publisher, Dehradun
3. Manikandan K and Prabhu S. 2012. Indian Forestry, Jain Brothers, New Delhi
4. Ram Parkash 1983. Forest Surveying. KhannaBandhu Book Publisher India.
5. Sharpe GW, Hendee CW & Sharpe WE. 1986. Introduction to Forestry. McGraw-Hill.
6. Simmons CE. 1980. A Manual of Forest Mensuration. Bishen Singh Mahender Pal Singh, Dehradun.
7. Ram Parkash 1983. Forest Engineering, International Book Distributor, Dehradun, India

Course Outcomes:

1. Students will achieve knowledge of tree measurement.
2. Students will develop skills for estimating the forest growing stock, volume, and age of the trees.
3. Students will learn tool & techniques of forest inventory.
4. Students will be able to plan construction of forest building, road and bridges.

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	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
CO4	3	3	2	1	3	1	2	3	3	3	3
CO5	3	3	2	1	3	1	2	3	3	3	3

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

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

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOCMJT2 UFOCMJP2	3	-	1	5 hours	30	70	30	70	200	4

Objectives:

1. To acquaint 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.
4. Two develop the selection skill of genetically superior tree.
5. To understand the applied aspect of tree improvement program.

Theory

Unit 1: Basic genetics principles – Plant cell structure and function, cell reproduction (Mitosis and Meiosis); Structure of DNA and RNA; Structure of chromosome, chromosomal aberration.

Unit 2: Mendel law of inheritance, deviation from Mendel law; Complementary gene, duplicate gene, pleiotropy, co-dominance, incomplete dominance, gene interaction.

Unit 3: Heritability, genetic advance, genetic gain, combining ability, Hardy-Weinberg equilibrium. Tree breeding – Variation in trees, natural variation, geographic variation.

Unit 4: 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.

Unit 5: 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. Visit 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.

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3. Fins, L., Friedman, S.T. and Brotschol, J.V. (1992). *Handbook of Quantitative Forest Genetics*, Kluwer 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 with 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 plus tree selection and provenance trial.

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

CO5: Students will be equipped to handle the tree improvement projects.

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	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
CO4	3	3	2	1	3	1	2	3	3	3	3
CO5	3	3	2	1	3	1	2	3	3	3	3

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

PAPER-III: VOC PAPER **(VOC-02)** **CR: 1+3**
Drawn from the University pool

PAPER-IV: MULTIDISCIPLINARY **(MDC-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

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SEMESTER – IV

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

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFODMJT1 UFODMJP1	4	-	1	6 hours	30	70	30	70	200	5

Objectives:

1. To understand and identify the forest tree seeds and viability aspects.
2. Two 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.
5. To understand the techniques of nursery operations.

Theory

Unit 1: Seed formation in forest trees. Classification of forest tree seed. Seed structure, chemical composition.

Unit 2: 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.

Unit 3: Storage of orthodox, recalcitrant seeds and fumigation and seed treatment. Seed cryopreservation, quality testing, purity, viability, moisture, vigor, and seed certification.

Unit 4: Quality seed production technology- seed orchard, selection of seed tree, plus tree, and elite tree. Seed certification agencies.

Unit 5: 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 biofertilizers.

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 (1987). Principle of Seed Certification and Technology, Elite Publishers

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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.

CO4: Students will understand quality seed production and seed certification processes.

CO5: Students development for application of nursery and propagation techniques for healthy plant production.

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
CO5	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 (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFODMJT2 UFODMJP2	4	-	1	6 hours	30	70	30	70	200	5

Objectives:

1. To provide knowledge about forest management for sustainable growth.
2. To develop knowledge about sampling techniques, use of GPS, and stand density measurement
3. The students will be able to understand various felling practices and silviculture system in different land use patterns.
4. To develop knowledge about rotation, normality, growth and yield models in Forest.
5. To develop and evaluate management plans in forestry and its allied subject for students.

Theory

Unit 1: Definition, objective, scope, and historical context of forest management. Forest management planning and administrative execution. Forest management and other branches of forestry.

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Unit 2: Forest management Methods for assessing forest resources, including sampling techniques, use of GPS, and stand density measurement. Developing long-term plans for sustainable forest management, setting objectives, developing strategies, and monitoring progress.

Unit 3: Application of silviculture system as tools for optimizing forest management decisions.

Unit 4: Concept of Rotations of forest crop, Normal forest, Estimation of growing stock and increment. CAI –MAI relationship, Yield regulation.

Unit 5: Working Plan- definition, objectives and necessity, Preparation of working plan. Joint forest management: concept and methodology

Practical

Assessment of forest resources by sampling techniques, stand density measurement. 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. Preparation of silvicultural treatment map. Case study of two JFM sites of Chhattisgarh.

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 learn various silvicultural systems for forest management.

CO4: Students will learn about growing stock of forest.

CO5: Students will be able to 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
CO4	3	3	2	3	2	1	2	3	3	3	3	3
CO5	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 (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFODMJT3 UFODMJP3	3	-	1	5 hours	30	70	30	70	200	4

Objectives:

1. To develop knowledge about ecological aspects and interactions in forest ecosystem.
2. To learn about ecosystem development and their role in ecosystems stability.
3. To develop knowledge about tree/plant diversity assessment.
4. To address the various ecological functions and processes of forest ecosystem.
5. To learn about the global issues related to forest.

Theory

Unit 1: Concept of ecology, Population ecology and Community ecology, Forest Ecosystem structure and functions, types of forest ecosystem.

Unit 2: Energy flow in ecosystem, Food chain, Food web, Ecological pyramids, Forest productivity, Biomass of trees, Concept of Succession.

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Unit 3: Vegetation dynamics, Species richness, Biodiversity, Types of biodiversity, measures of diversity, alpha, beta, gamma, Diversity indices, Threats to biodiversity.

Unit 4: Nutrient cycling and dynamics in forest ecosystem, Forest litter dynamics, Organic matter decomposition, Rhizosphere dynamics, nutrient conservation strategies in forest ecosystem.

Unit 5: Concept of global change ecology, major global issues (increasing atmospheric CO_2 concentration, land use change), Climate change, Carbon credit, Carbon trading, fluxes and transformations, impacts of global ecological changes on forests.

Practical

Determine the community structure of a forest stand, Vegetation assessment- Frequency, density, Dominance, IVI, Shannon-Weiner index, Simpson index, litter accumulation/decomposition determination in forest stand, Calculation of carbon stock, 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. Odum, E. P., & Barrett, G. W. (2005). Fundamentals of ecology (5th ed.). Brooks/Cole.
4. J.S. Singh, S. P. Singh., S. R. Gupta (2017). Ecology, Environmental Science and Conservation, S. Chand publication.
5. Oliver, C. D., & Larson, B. C. (1996). Forest stand dynamics (Update ed.). Wiley.
6. Perry, DA, Oren, R and Hart, S.C. (2008). Forest Ecosystems (2nd edition) The John Hopkins University press, Baltimore
7. Likens, G. E. (Ed.). (2010). Biogeochemistry of a forested ecosystem (2nd ed.). Springer.
8. Bonham, C. D. (2013). Measurements for terrestrial vegetation (2nd ed.). Wiley-Blackwell.

Course Outcomes:

CO1: Students will develop in-depth knowledge about ecological aspects and interactions in forest ecosystem.

CO2: Students will learn about ecosystem development and their role in ecosystems stability.

CO3: Student will develop knowledge about tree/plant diversity assessment.

CO4: Student will enhance knowledge on various ecological functions and processes of forest ecosystem.

CO5: Student will enhance knowledge on various global issues related to forest.

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
CO5	3	1	2	3	3		3	3	3	3	3	3

PAPER-IV: VOC PAPER (VOC-03) CR: 1+3
Drawn From the University pool

PAPER-V: ABILITY ENHANCEMENT COURSE (AEC-04) CR: 2
Drawn From the University pool

PAPER-VI: SUMMER INTERNSHIP (Compulsory for 2 years diploma course) CR: 4

SEMESTER – V

PAPER-I: Application of RS & GIS in Natural Resource Management (Major- 08) CR: 4+1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOEMJT1 UFOEMJP1	4	-	1	6 hours	30	70	30	70	200	5

Objectives:

1. To give exposure on the use of Remote Sensing, GPS and GIS technique in forestry.
2. To understand the application of remote sensing and GIS technique for the measurement and mapping of forest areas.
3. The assessment of land use land cover changes of forest area using modern tools and technique. Image acquisition, preprocessing and interpretation techniques.
4. The students will learn about the equipment used in forest survey.
5. The students will be able to use the various software's of GIS.

Theory

Unit 1: Introduction to Remote Sensing: Basics of Remote Sensing: Definition, history, and scope, Interaction of EMR with Earth surface features, Platforms and Sensors, Resolution

Unit 2: Satellite Data and Image Interpretation: Types of satellite imagery: IRS, Landsat, MODIS, Sentinel, etc., Image acquisition, preprocessing and interpretation techniques, Supervised and Unsupervised Classification techniques

Unit 3: Fundamentals of Geographic Information System (GIS): Definition and Components of GIS, Spatial and Non-Spatial Data, GIS Data Models: Raster and Vector, Data sources: Maps, GPS, Satellite data, Map projections, GIS software used

Unit 4: GIS Applications in NRM: NRM inventory and assessment using GIS, Forest type and cover mapping, Monitoring deforestation, forest degradation, and encroachment, Forest fire, LULC, Water cover mapping, Wildlife habitat mapping and corridor analysis

Unit 5: NRM Mapping Projects and Case Studies: National and International mapping programs (e.g., NRSC, FSI, FAO), Case studies on forest and watershed cover change detection, Recent trends: UAVs, Drone Mapping, AI in forest mapping.

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Practical

- Image interpretation using satellite imagery
- Hands-on training in GIS software (QGIS/ArcGIS)
- GPS data collection and mapping
- Forest/watershed/ LULC cover classification and map preparation
- Ground-truthing exercises in local forest areas

Suggested Readings:

1. M. Anji Reddy (1998). Textbook of Remote Sensing and GIS. B S Publications.
2. P.J. Curran (1985). Principles of Remote Sensing. Long man Group Ltd., England
3. L.F. Janssen (2000). Principles of Remote Sensing. ITC. Edl. Text Book Series II. The Netherlands
4. Rolf A.de By. (2000). Principles of Geographical Information Systems. ITC. Edl. Text Book Seriesl. The Netherlands
5. M.K. Sharma (1986). Remote Sensing and Forest Surveys, International Book Distributors, Dehra Dun.
6. B. Bhatta (2008). Remote Sensing and GIS. Oxford Publications.

Course Outcomes:

CO1: Students will learn about the application of Remote Sensing and GIS technology in NRM, change detection studies, as well as natural resource mapping.
CO2: Students will have field exposure and use GPS techniques, as well as mapping.
CO3: The students will be able to handle the surveying projects.
CO4: The students will develop competence in using the software's of GIS.
CO5: The learner acquainted about software

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
CO4	3	3	2	3	2	1	2	3	3	3	3	3
CO5	3	3	2	3	2	1	2	3	3	3	3	3

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

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

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOEMJT2 UFOEMJP2	4	-	1	6 hours	30	70	30	70	200	5

Course Objectives:

1. To expose the students with the wood identification, microscopic examination and wood properties.
2. To adhere with strength and mechanical characteristics of wood and its suitability for different applications.
3. To enrich students on understanding wood seasoning and preservation aspects.
4. To impart knowledge regarding the scope and processes for developing composite, engineered and modified woods.
5. To acquire knowledge on effective sawing methods and wood working.

Theory

Unit 1: Wood formation, kinds of wood, Microscopic anatomy of wood. Physical properties of wood. Wood density, specific gravity and methods of their determination. Wood moisture content and its measurement. Acoustic and thermal properties. Electrical properties.

Unit 2: Mechanical properties-elastic constants, plasticity, Hook's Law, Poisson's ratio, modulus of elasticity, Strength and elasticity; impact of defects on wood quality. Standard tests of timber specimen's- compression, tensile strength.

Unit 3: Wood water relationship, wood drying. Refractory and non- refractory wood, Wood seasoning, types- air, kiln and special seasoning methods. Seasoning and defects. Wood preservations, types of preservatives and its application.

Unit 4: Wood modification, its need and scope. Engineered wood: Plywood, laminated. Wood adhesives – types, characteristics and applications.

Unit 5: Wood machining and wood working. Saw mills and sawing techniques: simple sawn, star sawn.

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.

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Study of various wood based industries; Study on raw material requirement and sourcing of plywood, pulp and paper, matchwood, timber processing.

Suggested Reading:

1. Ansell MP. 2015. Wood Composites. Elsevier, Science and Technology.
2. Chauhan Laxmi and Vijendra Rao. 2003. Wood anatomy of Legumes of India: their identification, properties and uses. Bisen Singh and Mahendra Pal Singh, Dehradun.
3. Desch, H. E. (2016). Timber: Structure, Properties, Conversion. Woodhead Publishing.
4. ICFRE. (2018). Timber Identification Manual. http://www.icfre.org/.
5. Meier E. 2015. Wood Identifying and Using Hundreds of Woods Worldwide. Wood database.
6. Negi SS. 1997. Wood Science and Technology. International book distributor, Dehradun.
7. Rao KR and Juneja KBS. 1992. Field identification of 50 important timbers of India. ICFRE Publication, Dehradun, India
8. Rowell, R. M. (2012). Handbook of Wood Chemistry. CRC Press.
9. Terry Porter 2006. Wood: Identification and use. Guilds of Master Craftsman Publication.
10. Tsoumis G. 2009. Science and Technology of Wood. VerlagKessel
11. Wiedenhoeft, A. C. (2010). Structure and Function of Wood. USDA Forest Service.

Course Outcome:

1. Students will be acquainted with the wood identification.
2. Students will be exposed to mechanical characteristics of wood and its suitability for different applications.
3. Students will be enriched with understanding of wood seasoning.
4. Students will have knowledge regarding developing composite, engineered and modified woods.
5. Students will gain knowledge on effective sawing methods.

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
CO4	3	3	2	1	1	1	3	3	3	3	2
CO5	3	3	2	1	1	1	3	3	3	3	2

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

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PAPER-III: Forest Resource Economics & Management (Major-10) CR: 4+1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOEMJT3 UFOEMJP3	4	-	1	6 hours	30	70	30	70	200	5

Course Objectives:

1. To know the basic elements of forest economics for income generation.
2. The students will be able to gather knowledge on basic economic principles.
3. To develop the concept of production forestry.
4. To provide wider vision related to price and income elasticity in forestry.
5. To depart knowledge on marketing chains in global markets.

Theory

Unit 1: Basic concept of economics, nature and scope of economics and its relationship with other sciences, micro and macroeconomics, problems in forest economics and management, application of microeconomics in solving forest resource problems, economically important forest products, types of forest goods and services

Unit 2: Concept and types of demand, law of demand, measures of demand elasticity, Concept and types of supply, law of supply, measures of supply elasticity, emphasis on forest products demand and supply analysis, types and theory of utility, diminishing law of utility, equi-marginal utility and Hicks-Allen approach for determining consumer equilibrium, concept of revenue and uses, law of diminishing marginal returns.

Unit 3: Factors of production, their definition and characteristics, Marginal productivity theory, risk taking and uncertainty bearing theories of profit

Unit 4: Introduction to market, forest-based product market, classification and price determination under different market situations, forest produces in India and Chhattisgarh, forest land valuation, quantification and valuation of NTFPs.

Unit 5: National income and its concepts, concept and types of inflation, Carbon Credits, E-marketing

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

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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,I SBN: 9789388020671. Satish Serial Publishing House

Course Outcomes:

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

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

CO3: Student will be able to use various production factors and its utility in their own business

CO4: Student will understand the forest market and able to handle marketing channels

CO5: Student will be aware about the marketing trends of forest products condition and international market price of carbon credits.

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
CO5	3	2	3	3	2	3	3	2	2	3	2	2

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

PAPER-IV: MINOR PAPER **(Minor- 02)** **CR: 3 +1**

Drawn From the University pool

PAPER-V: WINTER INTERNSHIP (UFOEINT1) **CR: 2**

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SEMESTER – VI

PAPER-I: Forest Pathology and Entomology (Major- 11) CR:4+1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOFMJT1 UFOFMJP1	4	-	1	6 hours	30	70	30	70	200	5

Objectives:

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

Theory

Unit 1: General concept of forest protection. Abiotic and biotic forest damaging agencies. Forest fire and its impact on overall forest health. Forest fire monitoring systems.

Unit 2: Forest pathology: Classification of pathogens damages and cure. Biodegradation of wood - microscopic and chemical effects of white rot, brown rot, soft rot and wood discoloration. Heart rots - factors affecting heart rots, damage caused, compartmentalization of decay in trees and management of heart rots.

Unit 3: Forest entomology: Classification, types of insects and pests and its cure. Different types of the damage and its prevention.

Unit 4: Important diseases on 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.

Unit 5: 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.

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. Preparations of different pesticides. Preparation of fungicidal solutions; In-vitro efficacy and In vivo efficacy assessments.

Suggested Readings

1. Bakshi BK. 1976. *Forest Pathology*. Controller of Publications, GOI.
2. Jha LK & SenSarma PK. 1994. *Forest Entomology*. Ashish Publ. House.
3. S SNegi, 2006. *Handbook of Forest Protection*. International Book Dist., Reprint

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4. Schmidt, Olaf2006.*Wood and Tree Fungi: Biology, Damage, Protection and Use*. Today & Tomorrow's Printers and Publishers,New Delhi.
5. Paul. D. Mennan. 1991. *Tree Diseases Concept*. Prentice Hall.
6. 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 will gain knowledge about the growing of disease free forest.
4. Student will be able to learn about the concept of disease cycle and its preventive measures.
5. Student will be able to develop the knowledge of disease-free plantations.

CO	PO								PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1	1	1	1	3	3	3	1	1
CO2	3	3	1	1	1	1	2	3	3	3	2	2
CO3	3	3	3	1	1	1	1	3	3	3	2	2
CO4	3	3	1	1	1	1	2	3	3	3	2	2
CO5	3	3	3	1	1	1	1	3	3	3	2	2

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

PAPER-II: Agroforestry Management (Major- 12) CR: 4 + 1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOEMJT2 UFOFMJP2	4	-	1	6 hours	30	70	30	70	200	5

Objectives:

1. To develop student's competencies on tree based farming, and carbon monetization.
2. To understand the potential areas for outside forest plantations, commercial forestry and tree crop interaction.
3. To develop understanding on carbon sequestration potential of traditional and modern agroforestry systems.
4. To develop the best practices of agroforestry in plains and hill.
5. To develop competency on indigenous models of agroforestry.

Theory

Unit-I: Land use and land capability classification: definition, classification, and planning. Agroforestry: definition, aims, objectives, need and limitations for implementations. Components of Agroforestry, Criteria of selection of trees in agroforestry.

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Unit 2: Classification of agroforestry system-structural, functional, socio-economic, and ecological basis, multipurpose tree species and their characteristics. Agroforestry systems in different agroclimatic zones, components, production, and management techniques. Traditional Agroforestry systems: Taungya system, Shifting cultivation, Wind break, Shelterbelts, Homestead gardens

Unit 3: Tree-crop interaction: definition, kind of interaction-Positive interactions-complementarity- compatibility-mutualism, commensalism-Negative interactions-allelopathy and competition-Interaction Management-Aboveground and belowground interactions. Tree Management: crown and root management to minimize negative interaction- coppicing, lopping, thinning, pruning, and pollarding.

Unit 4: Trends in agroforestry systems research and development. Diagnosis and Design methodology-PRA-RRA tools in agroforestry problem diagnosis. People participation, rural entrepreneurship through agroforestry and industrial linkages.

Unit 5: Tree outside forests, social forestry, farm forestry, urban forestry, green belt, oxy-van, industrial plantations. National and International institutes related to agroforestry

Practical

Study characteristics of trees/shrubs/grasses for agroforestry. Volume and biomass estimation. Crown measurement, light interception and moisture measurement in agroforestry systems. Litter estimation and nutrient analysis, soil analysis, quantification of fertilizer doses. Annual crops/grass growth measurements and yield estimation carbon storage assessment. Tree species for outside forests, impact of tree vandalism on tree outside natural forest, carbon calculation in agroforestry and TOFs.

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. Dwivedi, A.P. (1992) Agroforestry principles and practices. Oxford and IBH Publication Co., New Delhi.
5. Huxley, P. (1999) Tropical agroforestry, Blackwell Science, Oxford. 371 p.
6. Khosla, P.K. and Khurana, D.K. (1987) Agroforestry for rural needs. Vol. I and II, ISTS, Solan, H.P.
7. Nair, P.K.R. (1993) An introduction to agroforestry. Kluwer Academic Publishers. 499 p.
8. Ong, C.K. and Huxley, P.K. (1996) Tree crop interactions – A physiological approach. ICRAF, Kenya. 386 p.
9. Pathak, P.S and Ram Newaj, (2012). Agroforestry, Potentials and Opportunities, Agrobios (India).
10. Ramakrishnan, P.S. (1992) Shifting agriculture and sustainable development. Man and biosphere series. The Parthenon Publishing Group. 424 p.
11. SenSarma, P.K. and Jha, L.K. (1993) Agroforestry. Indian Perspectives. Ashish Publishers, Delhi.

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Course Outcomes:

CO1: Students will get information on current scenario of agroforestry and tree outside forests.
CO2: Student's will develop competencies on tree farming.
CO3: Students will be able to identify the potential areas for agroforestry plantations.
CO4: Students will be able to estimate the demand and requirement related to timer and non wood forests products for industrial application.
CO5: Students will able to understand indigenous marketing of agroforestry.

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
CO5	3	1	3	3	3	2	3	3	3	3	3	3

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

PAPER-III: FOREST PRODUCTS AND UTILIZATION (Major-13) CR: 4 + 1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOFMJT3 UFOFMJP3	4	-	1	6 hours	30	70	30	70	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.
5. To develop trading knowledge of NTFPs.

Theory

Unit 1: Concept and definition, classification of forest products, importance of forest products, harvesting methods, transport, conversion and storage of wood, major forest products of India and Chhattisgarh, contribution to Indian economy

Unit 2: Wood and woody plant, properties of wood, wood based products and industries like furniture, construction, poles, beam, superstructures agriculture implements, musical instruments, sports goods

Unit 3: Definition and concept of NWFPs, classification of NWFPs, importance of NWFPs, minor forest products of India and Chhattisgarh

Unit 4: Collection and extraction process of dye, tannins, gums, resin, essential oils, kutch, bamboo, cane, sericulture, honey, tendu leaves, mahua, triphala, paper and pulp, fibre etc.

Unit 5: Marketing of forest products, problems and solution of marketing of forest products, value addition, trade and marketing of NTFPs and other products, quality assessment products

Practical

Field and campus visit for identification of timber yielding plants and Non Timber Forest Products, medicinal plants, collection and documentation of observed products and produces, visit to nearby wood-based industries, sanjeeveni mart and Chhattisgarh mart, tendu leaf processing and manufacturing of badi, essential oil extraction and distillation, NTFPs and livelihood analysis in nearby villages, visit to sericulture department, lac cultivation etc.

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 Distributor, Dehradun. 352 p.
4. Mehta T (2012) A handbook of forest utilization. Today and Tomorrow publishers.
5. Taank 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 be able to identify wood based forest products, harvesting methods, transport, conversion and storage of wood and contribution in tribal livelihood.

CO2: Student will be able to know the significance of wood based products and industrialization of these products.

CO3: Students will able to understand the scope of Non Timber Forest Products in future marketing trade

CO4: The students will develop skills in processing and collection of Non Timber Forest Products

CO5: Students will be equipped in marketing, trading and value addition of forest products

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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
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

PAPER -V: MINOR PAPER **(Minor- 03)** **CR: 3+**

Drawn From the University pool

SEMESTER – VII

PAPER- I: World Forestry and Community Development **(Major- 14)** **CR: 4+1**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOGMJT1 UFOGMJP1	4	-	1	6 hours	30	70	30	70	200	5

Objectives:

1. To understand the world forest distribution and aspects of biomes.
2. To study the world forest resources and recent trends.
3. To know about the biodiversity hotspots of the world and its distribution.
4. To identify the role of community in forestry.
5. To study the community development through forestry practices.

Theory

Unit 1: Geographical distribution and classification of world forest, Biogeographic regions of the world, Biomes-concept, types, characteristics, International and National Forestry Organizations.

Unit 2: Forest resources and Forestry practices in different regions of the world, Recent trends in Forestry development in the world.

Unit 3: Biodiversity hotspots- concept, distribution in the world, different timber species of the world, Impact of global issues on world forest (land use change, climate change, etc.)

Unit 4: Community Forestry- concept, history, component and functions, linkage between community forestry and natural resources management, forest societies, interactions between forests and people.

Unit 5: People's movements in forest conservation, community management and sustainable livelihood strategies, ecotourism and community development.

Practical

Plot the different forest biomes on the world map. Study about the different Bio-geographic regions of world & plot them on a map. Study of distribution of forest resources of South America, Africa, India, South East Asia and Europe. Study of different hotspots of the world. Study different timber species of the world. Study the role of community in ecotourism. Study of sacred groves. Ecosystem services of community forestry. Case studies of community forestry and development.

Suggested Readings:

1. V.K. Prabhakar (2000). Forestry and forest resources. Anmol Publication, New Delhi.
2. S S Negi (2003). Manual of forestry. Bishensingh, Mahendra Pal Singh, Dehradun.
3. Vyas GPD. 1999. Community Forestry. Agrobios

Course Outcomes:

CO1: Students will be able to know about the types of forest present in the world.
CO2: Students will explore about the forest resources of the world.
CO3: Students will know about the biodiversity hotspots of the world.
CO4: Students will be able to identify the role of community in forestry.
CO5: Students will learn community development through forestry practices.

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
CO5	3	1	2	3	2	2	2	3	3	3	3	3

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

PAPER-II: FOREST POLICIES, ACTS AND LEGISLATION (MAJOR-15) CR: 4+1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOGMJT2 UFOGMJP2	4	-	1	6 hours	30	70	30	70	200	5

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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4. To enhance the understanding of policy framework.
5. To develop knowledge of Intellectual Property Rights.

Theory

Unit 1: Forest policy – Relevance and scope, National Forest Policy – 1894, 1952 and 1988, Chhattisgarh Forest Policy Act 2001.

Unit 2: Criminal laws, Indian Penal Code, criminal procedure code; Indian Forest Act – 1927, Amendments to Indian Forest Act, 1927, Forest Conservation Act 1980, The Forest (Conservation) Amendment Bill, 2023.

Unit 3: 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.

Unit 4: Legal and policy frameworks related to forest conservation, Environment (Protection) Act 1986.

Unit 5: 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, RAMSAR, 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 awarenesss of International treatics and their uses in the local areas. Database preparation for different offences recorded in the forest.

Suggested Readings

1. Chaturvedi A.N. 2011. *Forest Policy and Law*, Khanna Bandhu.
2. *Indian Forest Acts* (with short notes), 1975. Allahabad Law Agency.
3. Jha L.K. 1994. *Analysis and Appraisal of India's Forest Policy*. Ashish Publ. House.
4. Poddar A.K. et al. 2011. *Forest Laws and Policies in India*. Today and Tomorrow Printers and Publishers, New Delhi.
5. Prabhakar V.K., 2001. *Laws on Forests*, Anmol Publication.
6. *National Forest Policy 1952*. Ministry of Food and Agriculture, New Delhi.
7. *National Forest Policy 1988*. Ministry of Environment and Forests, New Delhi.
8. Saharia, V.B. 1989. *Wildlife Law in India*. Natraj Publ.
9. Sairam Bhat. 2010. *Natural Resources Conservation Law*, Sage.
10. Negi S.S. 1985. *Forest Law*. Natraj Publ.

Course Outcome:

1. Students will be able to understand about forest and legal rights.
2. Students will understand key criminal laws and forest-related legal frameworks including the Indian Forest Act and its amendments.
3. Students will understand biodiversity and forest rights laws, national forest policies, and environmental legal issues in India.

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4. Students will understand legal and policy frameworks for forest and environmental conservation.
5. Students will recognize the importance of IPR, legal rights, landmark cases, and international forestry conventions.

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
CO5	2	3	2	3	2	3	3	2	3	2	3	2

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

PAPER-III: MOOC Course **(MOOC- 01)** **CR: 4**
(UFOGMOC1) Wildlife and its conservation /MOOC

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

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

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

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SEMESTER – VIII (4 Years Honours course)

PAPER I: BIOSTATISTICS AND RESEARCH METHODOLOGY (Major- 16) CR: 4 + 1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOHMJT1 UFOHMJP1	4	-	1	6 hours	30	70	30	70	200	5

Course 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.
5. To prove the hypothesis of different research objectives.

Theory

Unit 1: Introduction of forest statistics scales of measurement, types of data, classification and tabulation of data, frequency distribution, diagrammatic and graphical representation.

Unit 2: Central tendency: mean, median, mode, measures of dispersion: range, quartile deviation, mean deviation and standard deviation, probability.

Unit 3: Correlation: Concept, Karl Pearson's coefficient, Spearman rank correlation coefficient. Regression: Regression equations, linear and nonlinear regressions and regression coefficient.

Unit 4: Tests of significance: concept and applications of t-test, paired t-test, Z- test and Chi square test χ^2 –test.

Unit 5: Meaning and objectives of research, research design and planning, research ethics, plagiarism, referencing (APA, Harvard), citations, structure of a thesis/dissertation and scientific paper.

Practical

Handling computer-based histogram, frequency polygon, bar chart, pie chart, construction of frequency distribution table and its graphical representation, measures of central tendency: mean median and mode for raw and grouped data, measures of dispersion: range, mean deviation, quartile deviation and standard deviation for raw and grouped data, correlation and linear regression, t- test, paired-t test, Chi-square test for contingency tables and theoretical ratios.

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.

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Course Outcomes

CO1: Students enable to understand data types and sources of biostatistics in forestry and representation of data

CO2: Student will be efficient in basic data analysis of mean, median, mode and dispersion

CO3: Student will be able to find out the relationship between various variables through correlation and regression analysis

CO4: Student will be able to test the significance level of various type of problems

CO5: Student will be competent with basic research methods and concept

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
CO5	3	3	2	3	2	3	2	3	2	3	2	3

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

PAPER II: Forest based Entrepreneurship Development **(Major- 17) CR: 4 +1**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOHMJT2 UFOHMJP2	4	-	1	6 hours	30	70	30	70	200	5

Course Objectives:

1. Understand the fundamentals of forest-based business and its role in the sustainable management of forest resources.
2. Evaluate different models of forest entrepreneurship and recognize business opportunities in the forestry sector.
3. Analyse and apply forest-based business strategies that enhance innovation and sustainability.
4. Develop skills to create a business plan, including financial forecasting, risk management, and market analysis, for a forest-based enterprise.
5. Cultivate an entrepreneurial mindset with a focus on environmental sustainability, economic viability, and social responsibility in forest-based industries.

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Theory

Unit 1: Introduction to Forest Business and Entrepreneurship: Definition and scope of forest business. Forest products and services as business opportunities. Evolution of forest entrepreneurship: Global and local perspectives. Types of forest-based businesses (forestry operations, wood products, non-timber forest products, ecotourism).

Unit 2: Business Models in Forest Enterprises: Overview of forest business models. Timber-based and non-timber forest product-based enterprises. Ecotourism and recreation-based business models. Value chain analysis of forest products and services. Case studies of some successful forest businesses.

Unit 3: Forest Resources Management: Sustainable Forest Management practices for entrepreneurship. Resource inventory and forest product estimation. Legal and ethical considerations in resource use. Corporate social responsibility in forestry enterprises. Risk management and adaptive strategies in forest resource-based businesses.

Unit 4: Business Planning and Financial Management for Forest Enterprises: Developing a business plan for a forest enterprise. Financial modelling and budgeting for forest businesses. Investment and funding opportunities in forest-based businesses. Financial risks and insurance strategies. Financial performance evaluation and key performance indicators.

Unit 5: Marketing, Innovation, and Scaling in Forest Business: Market analysis and segmentation for forest-based products. Branding and marketing strategies. Innovation in forest business: Technology, product development, and sustainable practices. Social media and digital marketing for forest entrepreneurship. Scaling strategies for forest businesses: Growth, partnerships, and market expansion. Policy advocacy and networking for forest enterprises.

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 some programme for the entrepreneur skill and development, forest or wood-based industries cost benefit analysis.

Suggested readings:

1. Irish B Shahapurmath, SS 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. Bilhuti 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 & OP. Bhatnagar (1987) education & communication for development. Oxford university press, New Delhi.

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Course outcomes:

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

CO2: student promotions towards establishing start-ups in forestry field.

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

CO4: Students will learn making busyness plan for forest based industries.

CO5: Learner updates his entrepreneurial mindset.

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
CO4	3	3	3	3	2	3	3	3	3	2	2	3
CO5	3	3	3	3	2	3	3	3	3	2	2	3

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

Drawn from the University pool

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

Drawn from the University pool

SEMINAR **(SEM-02)** **CR: 3**

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

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

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SEMESTER – VIII (4 Years Honours with Research)

PAPER I: BIOSTATISTICS AND RESEARCH METHODOLOGY (Major- 16) CR: 4 + 1

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOHMJT1 UFOHMJP1	4	-	1	6 hours	30	70	30	70	200	5

Course 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.
5. To prove the hypothesis.

Theory

Unit 1: Introduction of forest statistics, scales of measurement, types of data, classification and tabulation of data, frequency distribution, diagrammatic and graphical representation.

Unit 2: Central tendency: mean, median, mode, measures of dispersion: range, quartile deviation, mean deviation and standard deviation, probability.

Unit 3: Correlation: Concept, Karl Pearson's coefficient, Spearman rank correlation coefficient. Regression: Regression equations, linear and nonlinear regressions and regression coefficient.

Unit 4: Tests of significance: concept and applications of t-test, paired t-test, Z- test and Chi square test χ^2–test.

Unit 5: Meaning and objectives of research, research design and planning, research ethics, plagiarism, referencing (APA, Harvard), citations, structure of a thesis/dissertation and scientific paper.

Practical

Handling computer-based histogram, frequency polygon, bar chart, pie chart, construction of frequency distribution table and its graphical representation, measures of central tendency: mean median and mode for raw and grouped data, measures of dispersion: range, mean deviation, quartile deviation and standard deviation for raw and grouped data, correlation and linear regression, t- test, paired-t test, Chi-square test for contingency tables and theoretical ratios.

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.

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Course Outcomes

CO1: Students enable to understand data types and sources of biostatistics in forestry and representation of data

CO2: Student will be efficient in basic data analysis of mean, median, mode and dispersion

CO3: Student will be able to find out the relationship between various variables through correlation and regression analysis

CO4: Student will be able to test the significance level of various type of problems

CO5: Student will be competent with basic research methods and concept

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
CO5	3	3	2	3	2	3	2	3	2	3	2	3

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

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

Drawn From the University pool

PAPER III: RESEARCH PROJECT/DISSERTATION **CR: 12**

Sub Code	L	T	P	Duration	IA	ESE (P)	Total	Credits
UFOHRPDSS S1	-	-	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.
2. To promote students on data analysis using online softwares.

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.

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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 (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOAMNT1 UFOAMNP1	3	-	1	5 hours	30	70	30	70	200	4

Course Objectives:

1. To 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

Unit 1: Definition, scope and importance of wildlife of India, justification of wildlife conservation, zoogeographic regions and biomes of the world, biogeographic classification of India.

Unit 2: Wildlife ecology (basic ecological concept-food chain food web, ecological pyramid etc.).

Unit 3: 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.

Unit 4: Human- wildlife conflict, threats and conservation of wildlife (In-situ and Ex-situ conservation).

Unit 5: 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

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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. International Union for Conservation of Nature (IUCN). (n.d.). *The IUCN Red List of Threatened Species*. https://www.iucnredlist.org
2. World Wide Fund for Nature (WWF). (n.d.). *Conservation reports and resources*. https://www.worldwildlife.org
3. Sinclair, A. R. E., Fryxell, J. M., & Caughley, G. (2006). *Wildlife ecology, conservation, and management* (2nd ed.). Wiley-Blackwell.
4. Dasmann, R. F. (1981). *Wildlife biology* (2nd ed.). Wiley.
5. Krebs, J. R., & Davies, N. B. (Eds.). (2009). *Behavioural ecology: An evolutionary approach* (4th ed.). Wiley-Blackwell.
6. Wilson, D. E., & Mittermeier, R. A. (Eds.). (2009). *Handbook of the mammals of the world* (Vols. 1–9). Lynx Edicions.
7. O'Connell, A. F., Nichols, J. D., & Karanth, K. U. (Eds.). (2011). *Camera traps in animal ecology: Methods and analyses*. Springer.
8. Primack, R. B., & Sher, A. A. (2016). *An introduction to conservation biology*. Sinauer Associates.
9. Ali, S. (2002). *The book of Indian birds* (13th ed.). Oxford University Press.
10. Menon, V. (2014). *Indian mammals: A field guide* (2nd ed.). Hachette India.

Course Outcome:

1. Students will know about the wildlife of the world.
2. Student will be competent to understand the behavior ecology of wild animals.
3. Students will be acquainted to about the census of wild animals.
4. The student will be able to manage human wildlife conflicts.
5. The student will be equipped in conservation techniques of wild animal.

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
CO5	3	2	2	3	2	1	2	3	3	3	3	3

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Minor 2 - EARTH CARE POLICY **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOEMNT1 UFOEMNP1	3	-	1	5 hours	30	70	30	70	200	4

Course objectives:

1. Creating the awareness about environmental problems.
2. Aware about the international agreements and policies for earth care.
3. Imparting basic knowledge about the international environment conservation policies.
4. To get knowledge about the various acts passed by Indian government.
5. Developing an attitude of concern for the environment.

Theory

Unit 1: Earth care policy, concept and need, historical background of various international and national practice for environmental conservation.

Unit 2: International agreements and policies for earth care, Ramsar convention, Stock home convention, IPCC, Kyoto protocol, COPs, Paris summit, CITES, CBD, Bonn convention, Montreal protocol, United nations framework convention on climate change.

Unit 3: Conservation policies of the ministry of environment, forest and climate change Govt. of India, NAPCC, National biodiversity action plan (NBAP), Nagar van udyan scheme, Project tiger, the national wetland conservation programme (NWCP), green skill development programme, National river conservation programme, Green india mission, National afforestation programme, National coastal management programme, National mission on Himalayan studies under climate change program.

Unit 4: 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.

Unit 5: functions of the central pollution control board (CPCB) and state pollution control board (SPCB).

Practical

Prepare a flashboard on recent updates 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. Environmentalism (pb): a global history: penguin

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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 be aware about the international agreements and policies for earth care.

CO3: Students will have the knowledge about the national and international environmental conservation policies and acts to safeguard the environment.

CO4: Students will get knowledge about the various acts passed by Indian government.

CO5: Students will be able to motivate public at larger scale to participate in environment protection strategies and actions.

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
CO5	3	2	2	3	2	1	2	3	3	3	3	3

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

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOFMNT1 UFOFMNP1	3	-	1	5 hours	30	70	30	70	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.
4. To know about the management of nursery.
5. To know about the marketing and financial management of nursery.

Theory

Unit 1: Introduction: definition, types of nurseries, 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.

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Unit 2: 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.

Unit 3: Nursery Business Management: principles, law of diminishing return, decision making, cost and price principles, labour efficiency measures.

Unit 4: 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.

Unit 5: 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. Makchau 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 learn about the various practices involved in establishment of nursery
CO3. Students will know about the management involved in establishing commercial nursery.
CO4. Students will be aware of the marketing channels in commercial nursery.
CO5. Students will be aware of the financial strategies in commercial nursery.

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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
CO5	3	2	2	3	2	1	2	3	3	3	3	3

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

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOGMNT1 UFOGMNP1	3	-	1	5 hours	30	70	30	70	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.
4. To know about the marketing of NTFPs.
5. To understand the economics of NTFPs.

Theory

Unit 1: NTFPs; definition, classification, economically important NTFPs of Chhattisgarh; sal, mahua, tendu, char, tamarind, amla, harra, bchada, jamun, mushrooms, lac, sericulture etc.

Unit 2: Concept of value addition, value addition its importance in NTFPs, 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.

Unit 3: 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, packaging and labelling; sustainable packaging options, designing attractive and informative labels, processing and value addition of specific NTFPs, medicinal and aromatic plants.

Unit 4: Quality control and assurance; standards and certifications for quality assurance of food, forest products, medicinal and aromatic plants.

Unit 5: Market analysis and strategies, market research and identifying target markets, developing effective marketing strategies for NTFPs, entrepreneurship and business planning of NTFP based enterprises.

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Practical

Field visits and resource assessment of forests for NTFPs assessment, learning field inventory techniques for NTFP assessment, processing and value addition processing on drying, packaging, and packing of NTFPs, honey processing, triphla and chawanprash formulation and processing, medicinal plant processing, essential oil extraction and product formation, mushroom based value addition practices, quality control measures and entrepreneurship of NTFPs, 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. Jenne H. de Beer, Melanie J. McDermott(1996).The Economic Value of Non-timber Forest Products in Southeast Asia Netherlands 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 concept of value addition of NTFPs.
CO3: Students will be able to understand processing of NTFPs with value addition
CO4: Students will be able to assure the quality parameters of value added products of forest based produces.
CO5: Student will be able to understand marketing strategy and entrepreneur skills in their future profession

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
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

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Minor 5 - URBAN FORESTRY AND DESIGNING **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOHMNT1 UFOGMNP1	3	-	1	5 hours	30	70	30	70	200	4

Course objectives:

1. Understanding the role of urban forest management and its scientific aspects.
2. To develop understanding about the various components of an urban forest.
3. To develop skills for Tree species selection and its management in urban sites.
4. To update students about various urban forest related legislations.
5. To develop problem-solving skills for environmental issues and pollution control through urban forests.

Theory

Unit 1: Urban forestry and its scope, distinction between urban and traditional forestry. Benefits of Urban Forestry to the environment and human well-being.

Unit 2: Understanding the components of an urban forest, including trees, soil, and other vegetation, and their interactions within the urban ecosystem.

Unit 3: Planning, design, Tree species selection and management of green spaces within urban environments.

Unit 4: Various relevant urban forestry policies, ordinances, and regulations at the local, state, and federal levels. Challenges in urban forestry. Role of the local community in urban forest management.

Unit 5: Significance of Urban Forestry in pollution control and quality urban life. Carbon footprint calculation in the urban green area.

Practical

Identification of various types of forest tree species found in urban environment. Case studies of urban forestry of urban areas of Chhattisgarh. Application of Species selection method for urban forestry. Identify the challenges in urban forestry and their management. Identify few success stories of urban forestry development in Bilaspur city. Study of Ecosystem services of Urban forestry.

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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 analyze urban forest structure and its functions, ecosystem services and values.

CO3:Students will develop skills for Tree species selection and its management in urban sites.

CO3:Students will be updated about various urban forest related legislations.

CO4: Students will be able to develop problem-solving skills for management issues involving urban and urbanizing forests.

CO5: Candidates improve their problem solving skill on climate change.

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
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

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Minor 6 - ECOTOURISM **(Credit- 3+1)**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOHMNT2 UFOGMNP2	3	-	1	5 hours	30	70	30	70	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 make students aware about the employment and scope of ecotourism.
4. To develop ideas about various livelihood aspects of ecotourism industries.
5. To give knowledge about the various case studies related to ecotourism.

Theory

Unit 1: Ecotourism: definition & concept. Ecotourism in national & Global context. Components of Ecotourism.

Unit 2: 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.

Unit 3: Ecotourism-based employment and scope, developing ecotourism product. Ecotourism and environment. Ecotourism and natural resource conservation. Ecotourism in protected area.

Unit 4: Community-based ecotourism. Code of ethics for ecotourism. Best practices and guidance for ecotourism sites.

Unit 5: Various case studies of eco-friendly practices in ecotourism industries challenge and scope.

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

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4. Wearing, S. and J. Neil. (1999). Ecotourism: impacts, potentials, and possibilities. Oxford: Butterworth-Heinemann.

Course Outcomes:

CO1: Students will be familiarize with current situations of Ecotourism.

CO2: Students will be able to know successful ecotourism destinations.

CO3: Students will be aware about the employment and scope of ecotourism.

CO4: Students will gain knowledge about the various case studies related to ecotourism.

CO5: Students will be able to develop ideas about various livelihood aspects of ecotourism 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
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

VOCATIONAL COURSES

VOC-1 - Nursery and Plantation Technology **(Credit- 1+3)**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOBVCT1 UFOBVCP1	1	-	3	7 hours	30	70	30	70	200	4

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.
4. To enrich students on plantation technologies
5. To update students on site specific plantation management.

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Theory

Unit 1: Introduction: Meaning and Definition of Nursery need of Nursery, Nursery Production Methods.

Unit 2: Nursery Establishment: types of nurseries, Site preparation, Size and shape of nursery bed, types of nursery bed, Infrastructure in nursery/other facilities, important propagation structures and containers.

Unit 3: Potting Media: Components of a Potting Media, Characteristics of a Good Potting Media, Factors to be considered while Selecting Ingredients for Media

Unit 4: Plantation Technology: Definition, Scope and Economic Importance of Plantation crops

Unit 5: Plantation Forests: Types and Establishment of Plantation forest crops, Enhancement Practices in Plantation Forestry

Practical

Study the tools and materials for plantation establishment, Visit small and large plantations- study their management and functioning, Study of Planting operations – Study of tending techniques, Planting methods and techniques for different types of plantations including energy plantation ,canal bank plantation, Pulpwood plantation, Study of forest development corporation plantation ,Road side plantations, Planting planning, Journal choice of species for plantation- economic considerations in plantation, Study Govt. vs Pvt. Plantation, Preparation of Production and planning schedule for bare root and containerized nurseries, Nursery site and bed preparation, Pre-sowing treatment of seed and planting materials, Mother bed and transplanted bed preparation, Intermediate nursery management operations, Preparation of ingredient mixture, study different types of containers and filling of containers, Preparation of nursery bed and seed sowing

Suggested Reading

1. Plant Propagation and Nursery management, Propagation Methods, school of agriculture, Indira Gandhi National Open University.
2. Sharma, R.R. (2002). Propagation of Horticultural crops, Principles and Practices, Kalyani Publishers, New Delhi.
3. Kanwar, J.S. and Bal, J.S. (2004). Practical Manual of Propagation and Nursery Management, Department of Horticulture, PAU, Ludhiana.
4. Krishnan, P.R., Kalia, R.K., Tewari, J.C. and Roy, M.M., (2014).
5. Plant Nursery Management: Principles and Practices. Central Arid Zone Research Institute, Jodhpur, 40 p. aul.
6. R.N. and B.N. Ganguly. (1963). Studies on the economics of raising nursery seedlings in the arid zones. Annals of Arid Zone. 1 (2).
7. Luna, R.K. (2006). In: Plantation forestry in India. International Book Distributors. Rajpur road, Dehradun. Pp. 1-93.

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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.

CO4: Students will learn about various plantation material used for different purposes.

CO5: Students will learn about plantation forestry and its 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	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
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

VOC-2 - ENVIRONMENTAL AUDIT (Credit- 1+3)

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOCVCT1 UFOCVCP1	1	-	3	7 hours	30	70	30	70	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.
4. To aware students on classification on nature and its managements.
5. To know about SDGs for future earth.

Theory

Unit 1: Environmental audit for city and industries. Concept of auditing environment: principle, needs and scope.

Unit 2: Environmental Impact Assessment, Environmental Auditing, Importance, Process, Auditors Responsibilities, Limitations.

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Unit 3: Environment Management System and Standards, Green audit, Energy audit, Component of environment audit.

Unit 4: Introduction To Solid Waste Management, water harvesting and usage of water, E-Waste Management, Carbon Foot Prints, Greenery analysis.

Unit 5: 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 cure', 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 know about the Environmental management systems and auditing process.

CO4. Students will know about types of waste and its management.

CO5. Students will be able to create awareness on various environmental aspects and sustainable development goals.

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

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CO4	3	2	2	3	2	1	2	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

VOC-3 - INDUSTRIAL PLANTATION (Credit- 1+3)

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFODVCT1 UFODVCP1	1	-	3	7 hours	30	70	30	70	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.
4. To identify pest and diseases of plantations and dare management.
5. To evaluate professional skill of students on green belt development.

Theory

Unit 1: Industrial plantations-definition, concept and scope. Needs of Industrial plantation.

Unit 2: 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.

Unit 3: Planning for the plantation, project preparation, and appraisal and project implementation– feasibility studies. Choice of species- establishment- maintenance- Nutrition in plantations.

Unit 4: 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.

Unit 5: 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.

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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 Turnbull, 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. Krishnapillay. 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. 571p. 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 learn about the types of pollution in industrial areas.
CO3. Students will know about the choice and management practices of tree species in industrial areas.
CO4. Students will be able to identify the pest and diseases in industrial plantation sites.
CO5. Students will be able to evaluate the site quality and suggest appropriate plantation strategy for industry affected lands.

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
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

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MULTIDISCIPLINARY COURSES

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

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
UFOAMDT1	3			3 hours	30	70	100	3

Course Objectives:

1. To study the importance of forests in ecological, economic, and social context.
2. To identify different types of forests and their characteristics.
3. To know the importance of biodiversity.
4. To know the linkages of tribals with forest.

Theory

Unit 1: Definition and significance of forest, productive and protective role of forest, Importance of forest, role of forest climate change mitigation.

Unit 2: Characteristics and distribution of forest types in India. Indian State of Forest report (ISFR). Tropical forest, Temperate forest, Mangrove forest.

Unit 3: Concept of Biodiversity, Floral and Faunal diversity, threats to forest ecosystems and biodiversity, conservation strategies, Importance of biodiversity conservation.

Unit 4: Land use change, Introduction to agroforestry systems, Tribal communities and their role in forest conservation. Forest dependence of tribals on forest resources.

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, Penguin 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 different types of forests and their characteristics

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CO3. Students will know the importance of biodiversity conservation.
CO4. Students will be aware of the linkages of tribals with forest resources.

MDC- 2- Introduction to Indian wildlife **(Credit- 3)**

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
UFOBMDT1	3	-		3 hours	30	70	100	3

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

Unit 1: Definition, scope and importance of wildlife of India, justification of wildlife conservation, zoogeographic regions and biomes of the world, biogeographic classification of India.

Unit 2: Wildlife ecology (basic ecological concept-food chain food web, ecological pyramid etc.).

Unit 3: 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.

Unit 4: Human- wildlife conflict, threats and conservation of wildlife (In-situ and Ex-situ conservation).

Unit 5: Agencies involved in wildlife conservation (BNHS, WWF, Indian Board for Wildlife, CITIES, Wildlife Crime control Bureau of India etc.).

Suggested readings:

1. International Union for Conservation of Nature (IUCN). (n.d.). *The IUCN Red List of Threatened Species*. https://www.iucnredlist.org
2. World Wide Fund for Nature (WWF). (n.d.). *Conservation reports and resources*. https://www.worldwildlife.org
3. Sinclair, A. R. E., Fryxell, J. M., & Caughley, G. (2006). *Wildlife ecology, conservation, and management* (2nd ed.). Wiley-Blackwell.
4. Dasmann, R. F. (1981). *Wildlife biology* (2nd ed.). Wiley.
5. Krebs, J. R., & Davies, N. B. (Eds.). (2009). *Behavioural ecology: An evolutionary approach* (4th ed.). Wiley-Blackwell.
6. Wilson, D. E., & Mittermeier, R. A. (Eds.). (2009). *Handbook of the mammals of the world* (Vols. 1–9). Lynx Edicions.
7. O'Connell, A. F., Nichols, J. D., & Karanth, K. U. (Eds.). (2011). *Camera traps in animal ecology: Methods and analyses*. Springer.

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8. Primack, R. B., & Sher, A. A. (2016). *An introduction to conservation biology*. Sinauer Associates.
9. Ali, S. (2002). *The book of Indian birds* (13th ed.). Oxford University Press.
10. Menon, V. (2014). *Indian mammals: A field guide* (2nd ed.). Hachette India.

Course Outcome:

1. Students will be expertise on the identification various wildlife and their conservation strategies.
2. Students may able to understand various institution and NGOs working on wildlife.

MDC-3- PLANTATION FORESTRY **(Credit- 2+1)**

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
UFOCMDT1	3	-		3 hours	30	70	100	3

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

Unit 1: Definition, scope and importance of Plantation. Plantation forests - planting plan, plantation records, maps. Plantation establishment- legal title of land, survey, site selection. Site preparation - purpose and methods.

Unit 2: Planting layout, time of planting, planting pattern, spacing, gap filling, planting methods, direct seedling.

Unit 3: Choice of species on ecological aspects - afforestation of dry land, wet land, other adverse sites. Enrichment planting nurse and cover crops.

Unit 4: Intercultural operations- weed control, climber cutting, staking, singling and pruning. Thinning - definition, objectives. Energy plantation. Climate change adaptation and mitigation through plantation forestry.

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)

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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)

7. **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.

SKILL ENHANCEMENT COURSES

SEC- 1: NURSERY TECHNOLOGY **Credit- 2+1**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOASCT1 UFOASCP1	2	-	1	7 hours	30	70	30	70	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

Unit 1 Nursery, introduction, objectives and scope and importance, types of nurseries. Nursery establishment - site selection-planning, and layout of nursery area.

Unit 2 Nursery beds: types of bed and nursery bed preparation, potting mixtures, transplanting of young seedlings. Type and size of container including root trainers.

Unit 3 Seed sowing: methods of sowing and intermediate operations, viz., pricking, watering, fertilization, weeding and hoeing. Green house and Mist chamber for propagation. Selection of growing medium- compost and mulches, nutrient and soil management.

Unit 4 Important nursery pests and diseases and their control measures. Marketing and sale of nursery seedling.

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.

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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.

SEC- 2: Wildlife Biology (skill based) **Credit- 2+1**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOBSCT1 UFOBSCP1	2	-	1	7 hours	30	70	30	70	200	3

Course Objectives:

1. To explore the biological basis of wildlife management and tools like biotelemetry and forensic analysis.
2. To develop the understanding about the behavioral changes and adaptation pattern.
3. To study wildlife conservation strategies, protected areas, and special conservation projects for endangered species.
4. To familiarize students with wildlife legislation, policies, and the role of conservation organizations.
5. To develop the understanding about the migration and adaptation pattern of different organism.

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Theory

Unit 1.

Introduction to wildlife biology; importance of studying wildlife; historical perspectives Evolutionary processes; biodiversity patterns; classification of major taxa.

Unit 2.

Animal Anatomy and Physiology Adaptations for survival; basic anatomical features; physiological processes Habitat and Ecosystems Types of habitats; ecosystem components; habitat requirements for species, Wildlife Behavior and Ecology Behavioral adaptations; foraging, mating, migration; ecological niches.

Unit 3.

Population Ecology, Population size estimation; growth models; factors affecting populations, Species Identification and Field Techniques Field survey methods; use of binoculars, GPS, camera traps; species identification guides

Unit 4.

Human-Wildlife Interactions Coexistence challenges; conflict mitigation; cultural perceptions Threats to Wildlife Poaching, habitat destruction, pollution, climate change,

Unit 5.

Wildlife Conservation Strategies, Protected areas, legal frameworks, community involvement, Protected Areas and Management, Design and management of reserves; success stories, Wildlife Research Methods, Data collection techniques; telemetry; GIS applications Current Issues and Future Directions Emerging threats; technological innovations; global initiatives

Practical

Present research proposals or case studies, Evolution of mammals, birds, reptiles, Practical: Anatomy identification, Field trip to local habitat, Case studies on migration patterns, Data analysis assignment, Case studies: Articles review Field visit or virtual tour, Group discussions; Student presentations.

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.

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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.

S.K. Tiwari, Wildlife Sanctuaries in India.

Course Outcome:

1. Students will be able to define and classify wildlife and explain its ecological and geographical distribution.
2. Learners will gain knowledge about wildlife behavior, population ecology, and habitat relationships.
3. Students will understand scientific methods of wildlife management and conflict resolution techniques.
4. Learners will evaluate conservation strategies and assess the role of national parks, sanctuaries, and Ramsar sites.
5. Students will interpret wildlife laws and analyze the contribution of national and international conservation bodies.

SEC- 3: Afforestation Techniques **(Credit- 2+1)**

Sub Code	L	T	P	Duration	IA (T)	ESE (T)	IA (P)	ESE(P)	Total	Credits
UFOCSCT1 UFOCSCP1	2	-	1	7 hours	30	70	30	70	200	3

Course Objectives:

1. To know about the scope of Afforestation and Reforestation.
2. To study about the factors affecting afforestation and reforestation.
3. To study the management operations involved in afforestation.
4. To depart knowledge on afforestation and wasteland development program.

Theory

Unit 1: Introduction: Definition, scope and objectives of Afforestation and Reforestation, Characteristics of natural and artificial regenerated forest.

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Unit 2: Regeneration methods in Forest, Factor affecting Afforestation and Reforestation, Selection of Suitable tree species.

Unit 3: Site selection for Afforestation, Layout and planting methods, Management practices in Afforestation Techniques.

Unit 4: Wasteland Afforestation, Types of waste land: Salt affected soil, Acid soil, Mined out areas, Shifting sand dunes and inland sands, Laterite Lands, Denuded and eroded hill slopes, Dry lands, Rock out crops land, Gullied and ravine lands.

Practical

Study the tools and materials for Afforestation establishment, Site Preparation, Seed selection and Planting method, Stand Management practices, Study afforestation in waste lands: Salt affected soil, Acid soil, Mined out areas, Shifting sand dunes and inland sands, Laterite Lands, Denuded And Eroded Hill Slopes, Dry lands, Rock out crops land, Gullied and ravine lands, Evaluation of Afforestation Benefits, Government policy and act related to Afforestation and Reforestation.

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 afforestation.
CO2. Students will be able to identify and know about the tree species used for afforestation.
CO3. Students will know the cultural operations and management operations involved in plantation activities.
CO4. Students will be able to identify different types of wastelands and plan afforestation.

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VALUE ADDED COURSES

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

Sub Code	L	T	P	Duration	IA	ESE (T)	Total	Credits
FOUAVAT1	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. To develop scientific, interpretive and creative thinking skills in the students about environment.
5. To explore the problems that we face in understanding our nature that correlate with socio-economical solution for sustainable development.

Unit I. Introduction to environmental studies, Humans and the Environment-

Multidisciplinary nature of environment, scope and importance, Man-environment interaction: Population growth and natural resource exploitation. Concept of sustainability and Sustainable Development Goals (SDGs).

Unit II- Natural Resources and Environment Pollution

Overview of natural resources: Classification of natural resources, Land resources, water resources, Energy resources; Environmental pollution types, causes, effects, controls; Solid waste management, 3R Principle.

Unit III- Biodiversity Conservation and environmental issues

Biological diversity concept; hot spots; Endangered and endemic species of India. Threats to biodiversity, man-wildlife conflicts; Conservation of biodiversity. Environmental issues at local, regional, and global scale.

Unit IV- Ecology & Ecosystems

Structure and function of ecosystem, Energy flow, food chains, food webs and ecological succession. Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems

Unit V. Climate Change: Impacts, Adaptation and Mitigation

Understanding climate change: greenhouse gas emissions, global climate change, temperature, rainfall, net zero targets for the future; Energy efficiency measures.

Unit VI: Environment Management, Environmental Policies, Acts, treaties and regulations

Introduction to environmental laws and regulation, Constitutional provisions, The Air (Prevention and Control of Pollution) Act; The Environment (Protection) Act, 1986; International agreements: Montreal and Kyoto protocols; UNFCCC; Kyoto Protocol.

Unit VII: Human Communities and the Environment

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Human population growth: Impacts on environment, Resettlement and rehabilitation of industrial and mining projects; Disaster and its management, major Environmental movements

Suggested readings

1. Erach Bharucha (2021).Text Book OF ENVIRONMENTAL STUDES FOR UG 3RD Edition. Orient Blackswan Pvt. Ltd. ISBN 9389211786
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 .एस आई .अध्ययन पर्यावरण .9789354426001 संस्करण तृतीय , .पृष्ठ ३१६ .हिंदी भाषाओरिएंट ब्लैक स्वान प्रा .लिमिटेड .
5. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
6. Sinha, N. (2020) Wild and Wilful. Harper Collins, India.
7. Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
8. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK
9. Miller, G. T., & Spoolman, S. (2015) Environmental Science, Cengage Learning.
10. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
11. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/.

Course Outcomes:

1. Have awareness on issues with environmental pollution, their effects and possible solutions.
2. Gain knowledge of natural resources, their significance, and the effects of human activity on the resources in environment.
3. Be familiar with biodiversity conservation and its significance.
4. Understand the need of sustainable development for future and become competent and socially responsible citizen of India.
5. Understanding sustainable development methods in the face of changing climates.

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MOOCS COURSES

Semester	Course	Course Code	Name of the course	Credit	Hour/ week	Marks
VII	MOOC	UFOGMOC1	Wildlife and its Conservation /MOOC	4	4	100
As per university instruction online/offline MOOC subject will be taught to the student if not available on online platform.						

Unit- 1. Values of wildlife. Wildlife and its scope in India. Types of wildlife and their status. Wildlife depletion and its causes. Wildlife corridors. Wildlife legislation. Wildlife Protection Act, 1972/ 8.

Unit- 2. Wildlife Safari. Wild animals projects. Wildlife and tribal welfare. Wildlife research in India and world. Wildlife education. India's wildlife. Karnataka's wildlife. Wildlife conservation.

Unit- 3. Importance of wild animals and their conservation. Wild animals and artificial insemination and captive breeding. Wildlife sanctuaries. National Parks. Biosphere reserves. Germplasm stations, seed banks and pollen banks. Zoological Gardens in India. Western Ghats

Unit- 4. Eastern Ghats. Himalayan Biodiversity. Government Institutions involved in wildlife research and conservation. NGO's involved in wildlife research and conservation. Ramsar wetlands. Mega biodiversity centres. Biodiversity hotspots. Biodiversity heritage sites.

Unit- 5. Biodiversity profile. Biodiversity Act, 2002. Biodiversity Development Authority (BDA). PBR and BMC's. Protected area network. Biodiversity mapping and prospecting. Wildlife census, techniques and biodiversity index.

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Curriculum and Credit Framework

FOR

M.Sc. FORESTRY& ENVIRONMENTAL SCIENCE

(CBCS)

(w.e.f. Academic session:2025-26)

"SCHOOL OF STUDIES 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

19/6/2025 19/6/25 19/6/2025 19/6/2

Course Structure

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

Semester	Course Opted	Course Code	Name of the Course	Credit	Hours/ week	Marks
I[st] SEM	Core-01	PGFOAT1	Advances in Silviculture	3	3	100
	Core-01 Practical	PGFOAP1	Advances in Silviculture	1	3	100
	Core -02	PGFOAT2	Forest Management	3	3	100
	Core -02 Practical	PGFOAP2	Forest Management	1	3	100
	Core-03	PGFOAT3	Forest Biometry, Surveying & Engineering	3	3	100
	Core-03 Practical	PGFOAP3	Forest Biometry, Surveying & Engineering	1	3	100
	Core -04	PGFOAT4	Forest Soil and Watershed Management	3	3	100
	Core -04 Practical	PGFOAP4	Forest Soil and Watershed Management	1	3	100
	OE-01	PGFOAOT	Essentials of Environmental Sciences	3	3	100
	OE-01 Practical	PGFOAOP	Essentials of Environmental Sciences	2	3	100
	TOTAL			21	30	1000
II[st] SEM	Core -05	PGFOBT1	Remote Sensing and GIS	3	3	100
	Core -05 Practical	PGFOBP1	Remote Sensing and GIS	1	3	100
	Core -06	PGFOBT2	Advances in Agroforestry	3	3	100
	Core -06 Practical	PGFOBP2	Advances in Agroforestry	1	3	100
	Core-07	PGFOBT3	Forest Products & Utilization	3	3	100
	Core-07 Practical	PGFOBP3	Forest Products & Utilization	1	3	100
	Core -08	PGFOBT4	Climate Smart Forestry and Forest Policy	3	3	100
	Core -08 Practical	PGFOBP4	Climate Smart Forestry and Forest Policy	1	3	100
	Core -9	PGFOBT5	Wildlife and its Conservation/MOOCS	3	3	100

	Core -9 Practical	PGFOBP5	Wildlife and its Conservation/MOOCS	1	3	100
	Core -10	PGFOBT6	Forest Genetics and Tree improvement	3	3	100
	Core -10 Practical	PGFOBP	Forest Genetics and Tree improvement	1	3	100
	Internship	PGINTB1	**Summer Internship (Two weeks)**	**Non-credit**		
	TOTAL			**24**	**36**	**1200**
III[rd] SEM	Core 11	PGFOCT1	Wood Science and Technology	3	3	100
	Core 11 Practical	PGFOCP1	Wood Science and Technology	1	3	100
	Core-12	PGFOCT2	Forest Protection	3	3	100
	Core-12 Practical	PGFOCP2	Forest Protection	1	3	100
	Core 13	PGFOCT3	Forest Ecology and Biodiversity Conservation	3	3	100
	Core-13 Practical	PGFOCP3	Forest Ecology and Biodiversity Conservation	1	3	100
	Core 14	PGFOCT4	Industrial Safety, EIA and Environmental audit	3	3	100
	Core-14 Practical	PGFOCP4	Industrial Safety, EIA and Environmental audit	1	3	100
	Core -15	PGFOCT5	Forest Statistics and Research Methodology	3	3	100
	Core -15 Practical	PGFOCP5	Forest Statistics and Research Methodology	1	3	100
	TOTAL			**20**	**30**	**1000**
IV[th] SEM		PGFODD1	Dissertation	**19**	**36**	**400**
Grand total				**84**	**132**	**3600**

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

- **Dissertation:** The dissertation topic will be allotted to the student in III Semester. It will be evaluated at the end of IV Semester. Students will choose research topic on his/her own interest on the topics related to forestry, wildlife and environmental sciences and will work under the supervisor allotted by the department.
- The Dissertation will be evaluated by the external examiner appointed by the competent authority of the University. Based on student dissertation report, presentation and viva voce the total marks (400) will be evaluated as; Dissertation report (Quality, content, statistics, graphic and figures/table etc.) 200 marks, Seminar (PPT Presentation) 100 marks, viva voce (Domain Knowledge and communication skills) - 100 marks.
- **Summer internship:** Students will complete the internship with forest department, Forest institutes, NGOs, and forest based industries/Nursery to learn about the various forest' operations, functioning of forest based industries and institutes or other organization as per their interest. However, he/she has to present certificate of internship and will make a presentation/ seminar at the end of the internship. The evaluation/ validation of internship will be done by the external/ internal examiner/HOD, based on student seminar/presentation.
- Two mid-term exams of 15 marks each (total 15+15-30) will be conducted considering summative and formative methods. End semester exam marks will be held of total 70 marks. The practical/dissertation courses will be evaluated for the total marks during the end semester only.
- **MOOCS:-** The students will be encouraged to register for the MOOCS course. However if students fail to register the course will be taught by the department.

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

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.

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 with its external features.
2. To develop the concept of nursery management and growing stock production through seeds, seed treatments and other propagation techniques
3. To perform the regeneration survey, production techniques of tree species and their adaptations to different types of environment.
4. To acquire knowledge on forest operations required for sustainable forest management through silvicultural system.
5. To understand about the silvicultural regimes and models.

Theory

Unit I. Introduction and classification of forest

Introduction to silviculture, objectives and scope, eco-physiology of tree growth, factors of the locality, bioclimate and microclimate effect, forest succession, forest classification on the basis of physiognomy, structure, function, floristic, dynamics, distribution, composition geographical/vegetation-based and internationally adopted norms of classification, other classifications , classification of world's forest types, Indian forest types and their distribution.

Unity II. Nursery techniques and seed treatments

Nursery and its importance in forestry, concept and component of modern nursery, types of nurseries temporary and permanent, bare root, containerized and clonal nursery, forest tree seeds and Pre-sowing seed treatments, seed sowing and intermediate operations, viz., pricking, watering, fertilization, weeding and hoeing.

Unity III. Natural and artificial regeneration

Regeneration techniques natural and artificial regeneration, regeneration of important forest tree species *Shorea robusta, Tectona grandis, Gmelina arborea, Eucalyptus spp. Dalbergia sissoo, Bamboo spp. Cedrus deodara* and *Pinus roxburghii*, regeneration survey and techniques.

Unity IV. Tending operation and silviculture system

Tending operation, importance, difference between tending operation and cultural operation, standard tree classification of regular crops, thinning and its types, introduction to silviculture systems.

Unit V. Silviculture regimes and models

Treatment analysis-silvicultural regimes- factors influencing choice of regimes, use of system analysis to determine regimes, models for evaluating silvicultural alternatives, development of silvicultural regimes to suit management objectives, optimum management strategies, silvicultural prescriptions for maximum production regime.

Practical

Tree identification and categorization in native and exotic tree species, classification of tree on the basis of density, composition, stories, structure, aged. Phonological study of few existing tree species during the semester *viz. Shorea robusta, Tectona grandis, Gmelina arborea, Eucalyptus spp. Bamboo spp. Dalbergia sisoo, Azadirachta indica, Millettia pinnata*. Study of site factors like climatic, edaphic, physiographic and biotic, conduction of regeneration survey of natural regeneration, layout of nursery bed for sowing, visit to forest areas to study forest composition, classification, factors of locality, site quality, form and growth of forest trees, standard tree classification of regular crops, pruning practices.

Suggested Readings

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

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

Puna, A K. 2013 *Agroforestry: Principles and Practices*, Today& Tomorrow's Printers and Publishers New Delhi.

Pradeep Krishan, 2013. *Jungle trees of Cenrtral India*. Penguin Books India.

Ralph D. Nyland. 2016. Silviculture: Concepts and Applications, Third Edition.

Smith DM, Larson BC, Ketty MJ, and Ashton PMS.1997.*The Practieves of Silviculture- Applied Forest Ecology*. John Wiley & Sons.Waveland Press, Inc.: Long Grove, IL.

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

Course Outcome:

1. Student will be able to understand on the characteristics of various tree species and forest classification of India with its external factors.
2. Student will develop the concept of nursery management and growing stock production through various seeds, seed treatments and other propagation techniques.
3. Student will learn to perform the regeneration survey, production techniques of tree species and their adaptations to different type of environments.
4. Student will be able to perform forest operations required for sustainable forest management through silviculture system.
5. Student will be able to understand the silvicultural regimes and models for evaluating silvicultural alternatives.

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

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

PAPER II : Forest Management

Course Objectives:

1. To provide knowledge about the forest management and organizational setup of forest department.
2. Students will get knowledge about forest asset evaluation and yield regulations
3. Students will be able to understand felling practices and silviculture systems.
4. To develop understanding on the sustainability components for forest resources management practices.
5. To make students aware about contemporary forest policies and national strategies for forest management and conservation

Theory

Unit 1

Principles of forest management, application and scope. Forest organizational setup of MoEF&CC and State forest department. Development of forest management in India.

Unit 2

Concept of Normality, Rotation: Meaning and types. Increment. Types of increment, Yield: Types of yield, Yield regulation in forest Management. Working plans and working schemes and their role in Forest Management.

Unit 3

Silviculture system, its types and applications in Forest Management. Clear felling, shelterwood, selection and coppice system, bamboo forest Management

Unit 4

Population growth and resource management. Management of Common Property Resources (CPRs) Concept of sustainability. SFM and its monitoring and evaluation. Micro-level planning and participatory rural appraisal.

Unit 5

Contemporary forest policies and national strategies and action plans for SFM asCarbon credit, CIFOR, REDD, REDD+ CAMPA, JFM, Assistant Natural Regeneration. Concept of sustainable tourism and people's participation.

Practical

Study of working plans of the forests. Estimation of MAI and CAI, Fixation of rotation for species. Perform a survey of forest area & chalk out a plan for silviculture management and preparation of silvicultural treatment map. 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..

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

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

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

Forestry for People. ICAR. Tiwari KM. 1988.

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

Course outcome:

1. Student will be able to understand the management and organizational setup of the forest department.

2. Students will be learnt the forest asset evaluation and yield regulations
3. Students will be able to understand different types of practices like felling, silviculture systems etc.
4. Student will be able to develop deep understanding on sustainable growth and management practices.
5. Student will be able to understand the contemporary forest policies and national strategies for forest management and its conservation.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	3	3	3
CO2	1	3	1	1	3	3	3	1
CO3	1	2	2	1	3	3	3	3
CO4	1	2	1	1	3	3	3	3
CO5	1	2	1	1	3	3	3	3

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

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

Course Objectives:

1. To acquaint students about tree/forest measurements and increment.
2. To develop skills for estimating the growing stock, volume, and age of the trees.
3. To understand the different methods and recent techniques of forest inventory.
4. To have the basic knowledge on forest surveying tools and techniques.
5. To know engineering aspects of forest building, road and bridge constructions.

Theory

Unit 1: Measurement of tree parameters: girth, diameter, height and form factor. Estimation of volume, growth and yield of individual tree and forest stands.

Unit 2: Determination of tree age and dendrochronology for growth history and climate change studies. Stump analysis and stem analysis for determining past growth. Preparation of volume table, yield table, stand table & its application in forestry

Unit 3: Forest inventory, sampling methods adopted in forestry. Quantification of regeneration and stand establishment. Measurement of crown density. Growth and yield prediction models – their preparation and applications.

Unit 4: Basic survey tools of forestry: Chain survey, plane table and compass survey. Remote sensing and GIS.

Unit 5: 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. 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 in forest areas.

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 measure the tree and increment.
2. Students will be able to estimate the growing stock, volume, and age of the trees.
3. Students will be understood the methods and recent techniques of forest inventory and yield.
4. Students will be learnt the uses of forest surveying tools and techniques.
5. Students will develop the engineering aspects of forest building, road and bridge constructions in forest area.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	3	3	3
CO2	3	3	2	1	3	3	3	1
CO3	3	3	1	1	3	3	3	3
CO4	3	3	2	1	3	3	3	3
CO5	3	3	2	1	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 the 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.
4. To develop the knowledge of soil water conservation.
5. To know the soil water and plant relationship with reference to the nature.

Theory

UNIT 1: Definition and importance of forest soils; classification and nomenclature of soils; physical, chemical and biological properties of forest soil. Difference between forest soil and other arable soils, Soil profile.

UNIT 2: Soils of the major forest biomes, soils under different forest types/plantations/land use systems. Soils and plant roots interactions. Soil degradationand its impact on forest ecosystem.

UNIT 3: Concept of soil fertility, impact of soil fertility onforest regeneration and forest composition.Soil organic matter. Humus formation, mineralization and immobilization, nutrient cycling, significance of C:N ratio. Microbial transformations of carbon and nitrogen.

UNIT 4: Biological Nitrogen Fixation and Mycorrhizal Associations in Forest. Fertilizers and Manures, Biofertilizers.

UNIT 5: Concept of watershed and watershed management. Characteristics of a watershed and their role in watershed management. Importance of watershed management, Ideo-types of watershed development plans and activities for the watershed. Criterion for watershed size determination.Integrated Watershed Management Programme (IWMP), Benefits of IWMP.

Practical

Determination of soil moisture, texture, porosity, bulk density; Determination of pH, EC, organic C &N, Soil aggregate analysis - dry and wet method, Estimation of MBC and MBN, Study of forest soil profile. Studies on types of fertilizers, biofertilizers 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

S I Bhuyan 2022. Advances in Soil & Forest Research. Publisher: Pencil (One Point Six Technologies Pvt Ltd. ISBN-13: 978-9356103481

Khan Towhid Osman. Forest Soils: Properties and Management 2013. Springer International Publishing. ISBN3319025406, 9783319025407

A K Muni; R Santhi and K M Sellamuthu. 2008.*Fundamentals of Forest Soils*. Satish Serial Publishing HouseISBN-10: 8189304518; ISBN-13: 978-8189304515Dhuruva Narayana, V.V., Sastry, G. and Patnaik, V.S. 1990. *Watershed management*.ICAR Publication, New Delhi.

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. .

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. Student will acquire sound knowledge on the physico-chemical and biological properties of forest soils.
2. Students will gain information on the nutrient transformation pattern in forest ecosystem.
3. Students will learn about the soil-plant-microbe interactions in forest ecosystem.
4. Students will be able to run different instruments used in soil analysis of forest soils.
5. Students will be enabled to prepare watershed map and management plan.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	3	3	1
CO2	3	3	2	1	1	2	3	3
CO3	3	3	1	1	3	1	1	1
CO4	3	3	1	1	3	1	2	2
CO5	3	3	1	1	3	3	3	1

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

PAPER Y: ESSENTIALS OF ENVIRONMENTAL SCIENCES CR. 5 (3+2)

Course Objectives:

1. To understand the basic concepts of environment and atmosphere.
2. To gain knowledge of Ecosystem structures and functions and biodiversity.
3. To understand the environmental pollution, its causes, impact and mitigation measures.
4. To study climate change, Global warming and carbon footprint assessments.
5. To learn about international environmental agreements and initiatives.

Theory

Unit – I

Environment: Definition, Scope and Component of environment. Atmospheric environment: definition, concept, structure (Layers) and composition of Atmospheric environment. Hydrosphere, Lithosphere, Biosphere.

Unit – II

Ecosystem: Definition and concepts of ecosystem, component of ecosystem, functions and structures of ecosystem, energy flow in ecosystem, food chain, food web, ecosystem pyramids, Different types of ecosystem, bio-geochemical cycles. Biodiversity: definition, threats and conservation of biodiversity (In-situ and Ex-situ conservation)

Unit – III

Environment Pollution: definition, concept, types. Air, water and soil pollution: major pollutants, causes and mitigation measures. Effects of environment pollution on human health and other organisms. Solid waste management: types of solid waste, collection and transportation of solid waste, waste treatment and disposal techniques.

Unit – IV

Global warming: definition causes and effects of global warming. Green house gases (GHGs). Climate change: Causes and impacts of climate change. Carbon Footprint: Concept, carbon sources and sinks, assessment methods of carbon footprint. EIA: steps and process.

Unit – V

Environmental Conventions, Agreements & Indian Initiatives: International agreements and policies -Ramsar Convention, Stockholm Convention, IPCC, Kyoto Protocol, COPs, Paris Agreement, Montreal Protocol. National policies & schemes: MoEFCC, CBD, G20 Summit, Green India Mission.

Practical

- Determine air pollution levels using biological indicators, such as lichen or leaf chlorosis studies.
- Analyze water samples for pH, turbidity, dissolved oxygen, and heavy metal presence using standard water testing kits.

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- Study the effect of industrial effluent on seed germination or plant growth to assess toxicity levels.
- Develop a climate change impact poster or model showcasing effects on forests, agriculture, and biodiversity.
- Simulate bioremediation experiment using pollutant-absorbing plants.
- Calculate personal or institutional carbon footprint using online calculators or manual estimation methods.
- Prepare a report on international and national environmental agreements, highlighting their objectives.

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 describe environmental concepts and atmospheric terminologies
2. Students will learn about Ecosystem services and biodiversity.
3. Students will understand different types of pollution Air, water and soil pollution causes and their mitigation methods.
4. Students will explain climate change impacts and calculate carbon footprint.
5. Students will recognize global agreements and national policies contributing to environmental sustainability.

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

SEMESTER II

PAPER I: REMOTE SENSING AND GIS CR: 3 + 1

Objectives:

1. To give exposure on the use of Remote Sensing, GPS and GIS technique in forestry and Environmental management.
2. To understand the application of remote sensing and GIS technique for the measurement and mapping of forest areas.
3. To understand the assessment of land use land cover changes of forest area using modern tools and technique. Image acquisition, preprocessing and interpretation techniques,
4. To develop the knowledge of the map making.
5. To understand the global prospective of satellite and its working principle.

Theory

Unit 1: Fundamentalsof Remote Sensing: Definition, history, and scope, Interaction of EMR with Earth surface features, Platforms and Sensors, Resolution, Satellite and UAVs

Unit 2: Satellite Data and Image Interpretation: Types of satellite imagery: IRS, Landsat, MODIS, Sentinel, etc., Image acquisition, preprocessing, and interpretation techniques, Supervised and Unsupervised Classification techniques, Accuracy assessment and Ground Truthing

Unit 3: Fundamentals of Geographic Information System (GIS): Definition and Components of GIS, Spatial and Non-Spatial Data, GIS Data Models: Raster and Vector, Data sources: Maps, GPS, Satellite data, Map projections, GIS software used

Unit 4: Applications of RS & GIS in Forestry and Environmental Management: Forest type and cover mapping, Biodiversity assessment and wildlife habitat mapping, Forest fire detection and risk zonation, LULC, Watershed management, Pollution monitoring (air, water, land), climate change indicators

Unit 5: Advanced Techniques and Case Studies: Hyperspectral and microwave remote sensing, UAV/Drone applications in forest and environmental monitoring, Case studies: Forest degradation, carbon stock estimation, land reclamation, Recent trends: AI/ML in RS-GIS, WebGIS, Cloud GIS platforms

Practical

- Hands-on experience in satellite data interpretation
- GIS operations: map creation, spatial analysis, thematic mapping
- GPS data collection and integration with GIS
- Field validation (ground truthing) exercises
- Mini-project on forest/environmental resource mapping

Suggested Readings:

1. M. Anji Reddy (1998). Textbook of Remote Sensing and GIS. B S Publications.
2. P.J. Curran(1985). Principles of Remote Sensing, Long man Group Ltd., England
3. L.F. Janssen(2000). Principles of Remote Sensing. ITC, Edl. Text Book Series II. The Netherlands
4. Rolf A.de By. (2000). Principles of Geographical Information Systems. ITC. Edl. Text Book Seriesl. The Netherlands
5. M.K. Sharma (1986). Remote Sensing and Forest Surveys, International Book Distributors, Dehra Dun
6. B. Bhatia (2008). Remote Sensing and GIS. Oxford Publications.

Course Outcomes:

CO1: Students will learn about the application of Remote Sensing and GIS technology in forestry and Environmental management.

CO2: Student will learn about the change detection studies, as well as natural resource mapping.

CO3: Students will have field exposure and use GPS techniques, as well as mapping.

CO4: student will explore to match the RS data with ground data.

CO5: student will be able to understand the mini project on forest and biodiversity mapping.

Course Outcomes and their mapping with Program Outcomes:

CO	PO					PSO			
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2	3	3	3	3
CO2	3	3	2	1	2	3	3	3	3
CO3	3	3	2	3	2	3	3	3	3
CO4	3	3	2	3	2	3	3	3	3
CO5	1	2	3	1	2				

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

PAPER II: ADVANCES IN AGRO-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 about tree crop interactions and their quantification.
3. To evaluate the parameter of biodiversity, sustainability, carbon trading and of climate smart agroforestry.
4. To boost the diagnostic ability of the students to design innovative and climate resilient agroforestry systems.
5. To enrich student understanding on preparation of commercial/bankable A/F proposals.

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Theory

Unit 1: Agroforestry: objectives, importance, potentials and limitations for implementations. Basis of classification of agroforestry systems. Structural and functional attributes of agroforestry systems, shifting cultivation, alley cropping, silvopastoral systems, shelter-belts and windbreaks, and home gardens.

Unit 2: Tree-crop interphase- factors affecting form and function in woody and non-woody plant component. Nature and types of interactions- positive and negative, aboveground and belowground interactions- competition, complementarity in resource sharing. Tree architecture and canopy management.

Unit 3: Agroforestry in soil productivity and moisture conservation. Nitrogen fixation and nutrient pumping. Agroforestry and biodiversity conservation (micro-site enrichment). Concept of sustainability and carbon trading/credit. Litter and fine root dynamics. Climate smart forestry.

Unit 4: Diagnosis and Design, PRA and RRA tools in agroforestry problem diagnosis. SWOT analysis of existing agroforestry practices.

Unit 5: Case studies on different agroforestry models (Teak, Eucalyptus, Moringa, Popular, Mango, etc.). Technical and financial analysis of various commercial A/F models.

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, determination of microclimate modifications, 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. Biodiversity assessment, carbon sequestration estimation.

Suggested Readings:

Chandra and Rajesh Kumar. 2024. Forestry Practicals (A complete practical solution for students) Scientific Publisher, Jodhpur, India

Dhyani, S. K. 2014. Agroforestry Systems in India. New Delhi: ICAR.

FAO. 2019. Climate-Smart Forestry Guide. http://www.fao.org/climate-smart agriculture/en/.

FAO. 2019. Agroforestry Resources. Available at: http://www.fao.org/forestry/en/.

Garrity, D. P. 2012. Agroforestry for Food Security. Wallingford: CABI.

ICAR. 2020. Agroforestry Framework. Available at: https://www.icar.gov.in/.

Jha, C. S. 2016. Agroforestry Practices in India. New Delhi: Oxford & IBH.

Jose, S. 2012. Agroforestry Ecosystem Services. Agroforestry Systems.

Kumar, A. 2018. Agroforestry in India. Dehradun: ICFRE.

Kala, C. P. 2019. Agroforestry Livelihoods. Dehradun: Bishen Singh Mahendra Pal Singh.

Leakey, R. R. B. 2017. Multifunctional Agroforestry. Amsterdam: Elsevier.

Mbow, C. 2014. Agroforestry and Sustainability. Agroforestry Systems.

MoAFW. 2014. National Agroforestry Policy. Available at: http://agricoop.nic.in/.

Nair, P. K. R. 2012. Agroforestry Principles (2nd ed.). Dordrecht: Kluwer Academic.

Sharma, B. D. 2017. Traditional Agroforestry Systems. New Delhi: Concept Publishing.

UNEP. 2021. Agroforestry Sustainability. Available at: https://www.unep.org/.

Course Outcome:

1. Students will gain knowledge on the concept of agroforestry as a sustainable land use system
2. Students will understand about tree crop interactions.
3. Students will be able evaluate carbon trading of climate smart agroforestry.
4. Students will be able to design innovative and climate resilient agroforestry systems.
5. Students will be able to evaluate commercial/bankable A/F proposals.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3
CO3	3	3	2	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	3	3

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

PAPER : III FOREST PRODUCT AND UTILIZATION

Course Objectives

1. To develop the understanding of the students on the status of wood based industries and its significance
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.
4. To develop the knowledge of marketing channel and it's implementation in life.
5. To understand the marketing and value addition in the NTFP

Theory

Unit I: Introduction to Forest Products

Introduction to forest products, classification, significance of wood and wood based industries in India and world, current import and export status of timber, various wood based products, logging and harvesting process of wood, transportation, conversion, storage.

Unit II Wood based products and its utilization

Woody plants characteristics, wood formation, physical and chemical properties of wood, important timber species used in construction purpose, handicraft industry: such as wood carving, basketry, furniture, joinery, cabinets, sports goods, sawmills, flooring and paneling, packaging, ships and boats, bark based products.

Unit III: Non-Wood Forest Products (NWFPs)

Classification of non-wood forest products, plant species produces gums, resins, katha, dyes, tannins, raw drugs, bamboo, canes and their collection, storage, processing, value addition, quality assestment and marketing.

Unit IV: Commercially important NTFPs processing

Tendu leaves collection and processing in central India, Lac culture, and Sericulture, rubber, pulp and paper manufacturing process.

Unit V: Medicinal & aromatic plants

Introduction of medicinal and aromatic plants of India and its significance, quality concern in plant based drug, cultivation techniques of important medicinal plants *Azadirachta indica, Terminalia arjuna, Rauvolfia serpentine, Optum poppy, Gloria superva* and other important aromatic species of the region, postharvest processing-drying, grading, storage and marketing, essential oils and their quality analysis.

Practical

Field visits and campus visits to identification and classification of timber and wood based

products, Non timber forest products, extraction of resins, gums, katha, dyes, tannins, oils raw drugs and other products, extraction of tannins, and essential oils, dyes, value addition, techniques for these products; cultural operations in MAP crops, visit to government and private pharmaceutical units/ institutes in adjoining areas, visit to nearby marketing/ trade centers, visit to non wood forest products based industries.

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.

Course Outcome:

1. Student will be able to identify timber species, conversion and its commercial significance
2. Student will be able to understand the wood based products and its utility to develop business concept
3. Student will learn about the collection, storage, processing, value addition, quality assessment and marketing of NTFPs
4. Student will learn the lac culture, sericulture, pulp paper processing, tendu leave collection and processing
5. Student will learn cultivation and marketing of medicinal, aromatic plants and essential oils.

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

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

PAPER IV: CLIMATE SMART FORETRY AND FOREST POLICY CR.4 (3+1)

Course objectives:

1: To develop the knowledge of climatic condition with reference to the global prospective.

2: To understand the different types of forest and its resilience in the nature.

3: To understand the carbon management in the natural and artificial conditions.

4: To develop the mitigation techniques in the students mind.

5: To understand the different treaties and the laws of the global climate change.

Theory

Unit : 1 Climate-Smart Forestry Principles : Integrating climate resilience into forest management; India's Green India Mission.

Unit 2: Adaptive Management: Species selection for drought and heat tolerance; soil conservation for climate resilience.

Unit 3: Mitigation Techniques, Enhancing carbon sequestration through agroforestry and reforestation; biochar applications.

Unit 4: Community-Driven Approaches: Engaging local communities in climate-smart practices; alignment with India's NDCs.

Unit 5: forest climate dynamics: modeling impacts on tree growth and species shift in Indian forest scenario.

Practical

- Resilient planting : Establish a plot with climate-adapted species
- Sequestration study : Measure carbon storage in a managed forest.
- Community training : Train locals on climate-smart techniques
- Field visits : Explore a climate-smart forestry project.

Suggested

- FAO. (2019). Climate-Smart Forestry Guide. FAO.
- Ravindranath, N. H. (2011). Climate Change and Indian Forests. Oxford University Press.
- Locatelli, B. (2018). Forests and Climate Change. CIFOR.

Open-Access: MoEFCC. (2015). Green India Mission. http://www.moef.gov.in/.

Course Outcomes:

1: Students will get knowledge about carbon sequestration in forest and its natural management.

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

3: Students will understand scientific methods of wildlife management and conflict resolution techniques.

4: Learners will evaluate conservation strategies and assess the role of national parks, sanctuaries, and Ramsar sites.

5: Students will interpret Forest laws and analyze the contribution of national and international conservation bodies.

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

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

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

Course Objectives:

1. To study the concepts, classification, and ecological significance of wildlife and its habitats.
2. To understand wildlife ecology, including population dynamics, food chains, behavior, and adaptations.
3. To explore the biological basis of wildlife management and tools like biotelemetry and forensic analysis.
4. To study wildlife conservation strategies, protected areas, and special conservation projects for endangered species.
5. To familiarize students with wildlife legislation, policies, and the role of conservation organizations.

Theory

Unit –I

Wildlife: definition, concept, values of wildlife. Zoological classification and Biogeographical classification of wildlife. Characteristics and distribution of wildlife. Wildlife biology: basic concepts, wildlife habits and habitat, component of wildlife.

Unit –II

Wildlife Ecology: introduction, definition, habitat, Ecological structures and food chains of wildlife, population ecology of wildlife. Sign and symptoms of wildlife. Animals behavior and adaptations of wildlife.

Unit –III

Biological basis of wild life management: definition and scope, breeding potential, saturation point, biological surplus, carrying capacity, population dynamics. Management of shelter, food, and water. Biotelemetry, Forensic Analysis, Wildlife pathology, wildlife crimes, Human wildlife conflict.

Unit –IV

Wildlife conservation: Definition, Concept, significance. Wildlife conservation: In-situ and Ex-situ wildlife conservation. Role of protected area in wildlife conservation. Role of National parks and sanctuaries for conservation of wildlife. Ramsar wetlands. Special conservation projects for endangered species: Project tiger, Gir Lion Project, Crocodile Breeding Project, elephant project etc. Endangered and Threatened Species

Unit –V

Wildlife Policy and Legislation: Wild life protection act 1972, Scheduled animals, National Wildlife Action Plans (NWAP). Tiger census, National Park and Sanctuaries of Chhattisgarh. Wildlife Conservation organization: role and significance of National and International organization in wildlife conservation.

Practical

- Identify wildlife signs and symptoms (like pugmarks, droppings, traits, sounds) using field guidebooks or trail cameras.
- Prepare a report on in-situ and ex-situ conservation practices through case studies of national parks and zoological parks.
- To prepare case study on a special conservation project such as Project Tiger or Gir Lion Project.
- Demonstrate the use of biotelemetry tools and techniques through models or video demonstrations.
- Analyze a wildlife crime case study to understand wildlife forensic analysis and legal procedures.

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.

S.K. Tiwari, Wildlife Sanctuaries in India.

Course Outcome:

1. Students will be able to define and classify wildlife and explain its ecological and geographical distribution.
2. Learners will gain knowledge about wildlife behavior, population ecology, and habitat relationships.
3. Students will understand scientific methods of wildlife management and conflict resolution techniques.
4. Learners will evaluate conservation strategies and assess the role of national parks, sanctuaries, and Ramsar sites.
5. Students will interpret wildlife laws and analyze the contribution of national and international conservation bodies.

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

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

PAPER-VI: FOREST GENETICS AND TREE IMPROVEMENT **CR: 3+1**

Objectives:

1. To acquaint 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.
4. Two develop the selection skill of genetically superior tree.
5. To understand the applied aspect of tree improvement program.

Theory

Unit I-Basic genetics principles – Plant cell structure and function, cell reproduction (Mitosis and Meiosis); Structure of DNA and RNA; Structure of chromosome, chromosomal aberration.

Unit II-Mendel law of inheritance, deviation from Mendel law; Complementary gene, duplicate gene, pleiotropy, co-dominance, incomplete dominance, gene interaction.

Unit III-Heritability, genetic advance, genetic gain, combining ability, Hardy-Weinberg equilibrium.Tree breeding – Variation in trees, natural variation, geographic variation.

Unit IV-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.

Unit V-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*, Kluwer 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:

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

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

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

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

5:Students will understand the tree improvement techniques.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	3	3	1
CO2	3	3	3	1	3	3	3	3
CO3	3	3	2	3	3	3	3	3
CO4	1	1	3	3		1	3	3
CO5	2	2	2	1		2	2	1

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

SEMESTER-III

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

Course Objectives:

1. To acquaint the students with the wood identification, microscopic examination and wood properties.
2. To adhere with strength and mechanical characteristics of wood and its suitability for different applications.
3. To enrich students on understanding wood seasoning and preservation aspects.
4. To impart knowledge regarding the scope and processes for developing composite, engineered and modified woods.
5. To acquire knowledge on effective sawing methods and wood working.

Theory

Unit 1: Wood formation, kinds of wood, Microscopic anatomy of wood. Physical properties of wood. Wood density, specific gravity and methods of their determination. Wood moisture content and its measurement. Acoustic and thermal properties. Electrical properties.

Unit 2: Mechanical properties-elastic constants, plasticity, Hook's Law, Poisson's ratio, modulus of elasticity, Strength and elasticity; impact of defects on wood quality. Standard tests of timber specimen's-compression, tensile strength. Mechanics and Rheology of wood, abrasion, brittleness and hardness.

Unit 3: Wood water relationship, wood drying. Refractory and non- refractory wood. Wood seasoning, types- air, kiln and special seasoning methods. Seasoning and defects. Wood preservations, types of preservatives and its application.

Unit 4: Wood modification, its need and scope. Engineered wood: Plywood, laminated. Wood adhesives – types, characteristics and applications.

Unit 5: Wood machining and wood working. Saw mills and sawing techniques: simple sawn, star sawn.

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:

Ansell MP. 2015. Wood Composites. Elsevier, Science and Technology.

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

Desch, H. E. (2016). Timber: Structure, Properties, Conversion. Woodhead Publishing.

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

ICFRE. (2018). Timber Identification Manual. http://www.icfre.org/.

Meier E. 2015. Wood Identifying and Using Hundreds of Woods Worldwide. Wood database.

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

Rowell, R. M. (2012). Handbook of Wood Chemistry. CRC Press.

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

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

Wiedenhoefl, A. C. (2010). Structure and Function of Wood. USDA Forest Service.

Course Outcome:

1. Students will be acquainted the students with the wood identification, microscopic examination and wood properties.
2. Students will be adhered with strength and mechanical characteristics of wood and its suitability for different applications.
3. Students will be enrichedwith understanding wood seasoning and preservation aspects.
4. Students will have knowledge regarding the scope and processes for developing composite, engineered and modified woods.
5. Students will be acquired knowledge on effective sawing methods and wood working.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	3	3	2
CO2	3	3	2	1	1	3	3	2
CO3	3	3	2	1	1	3	3	2
CO4	3	3	2	1	1	3	3	2
CO5	3	3	2	1	1	3	3	2

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

PAPER II. 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.
4. To develop the knowledge of disease control and pest management.
5. To understand the host specific insect pest in the specific plants.

Theory

Unit I: General concept of forest protection. Abiotic and biotic forest damaging agencies. Forest fire and its impact on overall forest health. Forest fire monitoring systems.

Unit II: Forest pathology classification damaging types and its cure. Biodegradation of wood - microscopic and chemical effects of white rot, brown rot, soft rot and wood discoloration. Heart rots - factors affecting heart rots, damage caused, compartmentalization of decay in trees and management of heart rots.

Unit III: forest entomology classification damaging types and its cure. Different types of the damage and its prevention.

Unit IV: Important diseases on 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.

Unit V: 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.

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. 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 &SenSarma PK. 1994.*Forest Entomology*.Ashish Publ. House.

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

Schmidt, Olaf2006.*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.
4. Student will be able to learn the concept of disease cycle and its preventive measures.
5. Student will be able to develop the knowledge of disease free plantation and its impact.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	3	3	1
CO2	3	3	3	1	3	3	3	3
CO3	3	3	2	3	3	3	3	3
CO4	1	1	3	3		1	3	3
CO5	2	2	2	1		2	2	1

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

PAPER III. FOREST ECOLOGY AND BIODIVERSITY CONSERVATIONCr. 4 (3+1)

Course Objectives:

1. To understand the basic concept of forest ecology, structure and functions of forest ecosystem.
2. To acquire knowledge on ecosystem development, disturbances and nutrient cycling in forest.
3. To understand the biodiversity and methodsto assess biodiversity.
4. To understand the biological diversity.
5. To develop the global climate change and its mitigation techniques.

Theory

Unit 1: Concepts of forest ecology, forest ecosystem, forest population, forest community dynamics, forest community structure and function.Forest productivity on a global scale, Ecology of forest landscapes spatial heterogeneity, Hierarchy issues in ecology.

Unit 2: Ecosystem development, Ecological restoration, Forest disturbances, Biogeochemical cycles, Nutrient dynamics in forest, plant-soil-microbe interactions.

Unit 3: Biodiversity-an overview, types of biodiversity, genetic, species and ecosystem diversity, Species richness, Endemism, Indicator species.Plant genetic resources and conservation.

Unit 4: Biodiversity Conservation strategies, In-situ and Ex-situ conservation, Biodiversity Hotspot, Wildlife Sanctuaries, National parks, Biosphere reserve, Botanical Gardens, Zoological Parks.

Unit 5: Climate change impact on biodiversity, Global warming and forests, Biodiversity Conservation laws and acts, International programs for biodiversity conservation, CBD, CITES, TRIPS agreement and IPR.

Practical

Study of forest community structure, Estimation of productivity of forest ecosystem, Study of vegetation composition, biomass estimation, Methods of vegetation analysis, IVI, Shannon diversity index, Simpson index, Use of online diversity estimation tools.Identify the disturbances to forest ecosystems in local, regional and global level, Quantification of litter production and decomposition, Herbarium Preparation, Trip to different regions of the state to study forest vegetation, Visit to National parks, Wildlife sanctuaries, Botanical gardens and arboreta.

Suggested Readings

Daniel M. Kashian, Donald R. Zak, Burton V. Barnes, Stephen H. Spurr. 2023. Forest Ecology, 5th Edition, ISBN: 978-1-119-47608-5

Eugene P. Odum and Gray W. Barrett, 5th Edition, 2005 Fundamentals of Ecology

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

J. P. Kimmins. 2004. Forest Ecology: A Foundation for Sustainable Forest Management and Environmental Ethics in Forestry, Prentice Hall, ISBN-0130662585, 9780130662583

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

Malik, Ashok. 2008. *Dynamics of Forest Ecosystems*. Today & Tomorrow's Printers and Publishers, New Delhi.
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.
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 learn about forest ecosystem structure and its functions.
2. Students will acquire knowledge on succession, types of disturbance and nutrient dynamics in forest ecosystem.
3. Students will know the importance of biodiversity and their role in forest ecosystem functioning.
4. Students will develop knowledge on various methods adopted for conservation of biodiversity and measurements.
5. Students will know about the impact of global issues on biodiversity and identify various national and international organizations related to biodiversity conservation.

CO	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	1	3	1	3	3	3	3
CO2	3	1	2	1	3	3	3	3
CO3	3	1	2	1	3	3	3	3
CO4	3	1	2	1	3	3	3	3
CO5	3	1	2	1	3	3	3	3

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

PAPER IV- INDUSTRIAL SEFTY, EIA AND ENVIRONMENTAL AUDIT Cr.4 (3+1)

Course Objectives:

1. To understand the concepts, procedures, and guidelines related to Environmental Impact Assessment (EIA).
2. To study about environmental auditing, its phases, techniques, and international environmental standards.
3. To understand the scope and types of industrial hazards, and the importance of occupational health and safety.
4. To study industrial safety laws, emergency response mechanisms, and accident prevention strategies.
5. To develop understanding of environmental risk analysis, including risk identification, communication, and management.

Theory

Unit – I

Environmental Impact Assessment (EIA): Definition, Concept, Categorization of project, steps and procedure of EIA, Authority involved in EIA process, EIA guidelines 1994, EIA of development projects, EIA of restored mine lands.

Unit – II

Environmental Audit: introduction, definition, types of environmental audit, phases of environmental audit process (Pre-audit, onsite- audit, post-audit). Tools and techniques of environmental audit. Environmental standards: ISO 14001.

Unit – III

Industrial safety and occupational health hazard: definition, needs, scope of industrial safety. Types of industrial hazards: mechanical, electrical, thermal, fire, radiation and explosion hazard. Techniques of hazard identification. Occupational health and safety of workplace.

Unit-IV

Industrial Safety laws and Standards: Indian factories Act, Explosive Act, BIS, OSHA standards, ISO 45001, Occupational health and safety management system. Accident Prevention and Emergency Response during industrial hazards: Causes of accidents, prevention strategies, safety drills, first aid, and fire-fighting techniques.

Unit-V

Environmental Risk analysis: Definition, Concept of Risk, Distinction between hazard and risk, Sources of environmental risk, types of risks, Risk characterization, purposes of environment risk assessment, Risk communication, Risk management strategies, Tools and techniques of risk analysis.

Practical

- Prepare a mini Environmental Impact Assessment (EIA) report for a small-scale development project.
- Conduct a safety audit and hazard identification in an industrial or laboratory setup using a standard checklist.
- Measure noise and light intensity in a workplace using a sound level meter and lux meter.
- Prepare a sample Environmental Audit report of different activities.
- Survey and identify various industrial hazards (mechanical, electrical, thermal, etc.) in a local industrial setup or case study.
- Demonstrate the use of Personal Protective Equipment (PPE) and prepare a safety checklist for workplace health.
- Analyze a case study of an environmental disaster (e.g., Bhopal gas tragedy) to understand risk communication and management.

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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 cure', Oxford University press, New Delhi. Third Edition.
4. Santra S.C., (2014). 'Environmental Science', New Central Book Agency Pvt. Ltd, Kolkata. Third Edition.
5. Krishnamoorthy, B. (2009). Environment Management -Text and Practices, New Delhi: Prentice Hall India. www.prenticehall.india.org third edition
6. Karpagam M. and Jaikumar G. (2010). 'Green Management – Theory and Applications' Ane Books Pvt. Ltd. New Delhi.
7. Manahan, S.E. (1997). Environmental Science and Technology. Lewis, New York.
8. Metcalf and Eddy (Eds). (2003). Wastewater Engineering: Treatment and Reuse, Tata McGraw-Hill, New Delhi.
9. Thomas, J.A. and Fuchs, R. 2002. Biotechnology and Safety Assessment. Academic Press.
10. Wang L.K. Hung Y.T. nad Shammas N.K.(Eds). 2006. Advanced Physicochemical Treatment Processes. Springer-Verlag New York, LLC.

Course Outcome:

1. Students will be able to explain the **steps and application of EIA** in evaluating development and mining projects.
2. Learners will gain the ability to perform and interpret **environmental audits** using relevant tools and standards like **ISO 14001**.
3. Students will identify and assess **various industrial hazards** and recommend **occupational health** measures.
4. Learners will apply **safety regulations and emergency protocols** based on legal frameworks such as **OSHA and BIS**.
5. Students will demonstrate the skills to conduct **risk assessments** and implement **risk management strategies** in environmental settings.

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

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

PAPER V.FOREST STATISTICS & RESEARCH METHODOLOGY

Course Objectives:

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

Theory

UNIT I: Introduction to statistics & data types

Importance of statistics in forestry and environmental sciences, scales of measurement, types of data: qualitative, quantitative, continuous, discrete, classification and tabulation of data, frequency distribution, diagrammatic and graphical representation.

UNIT II: Descriptive Statistics and Probability

Central tendency: mean, median, mode, measures of dispersion: range, quartile deviation, mean deviation and standard deviation, variance, covariance, basic concept of probability.

UNIT III: Correlation and Regression

Concept of variables, correlation: Karl Pearson's coefficient, Spearman rank correlation coefficient, regression: regression equations, linear and nonlinear regressions and regression coefficient.

UNIT IV: Statistical Inference and Hypothesis Testing

Concept of sampling and sampling methods (random, stratified, systematic), Population and sample, parametric and non parametric tests of significance: t- test, paired t-test, Z- test and χ^2 -test.

UNIT V: ANOVA and experimental designs

Analysis of Variance (ANOVA) - one way and two way analysis of variance, experimental 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

Identification of source of data qualitative and quantitative parameters, arrange forest based statistical data in group, class and table, represent in different diagram and graphical ways, frequency distribution, forest based measurements: 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

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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.

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

Surendran C, Sehgal R N & Paramathma M. 2003. Statistical Methods for Agricultural Workers. ICAR.

Rangaswamy, R. A. 2010. Text Book of Agricultural Statistics, New Age International Pvt Ltd Publisher, ISBN-9788122425925, 9788122425925

Chandel, S R S. 2014. A Handbook of Agricultural Statistics, Impact Publisher

Course Outcome:

1. Student will be able to differentiate sources of observation to arrange in groups, classes and tables, competency for data handling, graphical designing and test of experimental data statistically
2. Student will be competent to analyze mean, median, mode, measures of dispersion, variance and probability
3. Student will be able to analyze the relationship between different variables correlation & regression coefficient
4. Student will be able to do sampling in forest area and able to perform test of significance of different parametric and non parametric test
5. Student will be able to the layout experimental designs, expertise on different statistical packages used for data analysis

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

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

SEMESTER IV

PAPER I: DISSERTATION **CR: 19**

Course Objective

1. To provide an opportunity to unearth new information related to new and Nobel 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.
4. To understand the research knowledge and its implementation in the global research.
5. To understand the global interest on the research and different types of methodology.

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.

CO3: student will learn the different methodology for the research.

CO4: student will learn the presentation (poster/oral presentation)

CO5: to develop the research temperament in the student mind for the future need of career

Course Outcomes and their mapping with Program Outcomes:

	PO					PSO		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	3	3	1
CO2	3	3	3	1	2	3	3	2
CO3	3	2	2	1	3	3	3	1
CO4	3	3	2	1	3	3	2	2
CO5	3	2	1	2	2	3	3	2

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