SYLLABUS FOR

FOUR YEAR UNDER GRADUATE PROGRAMME (FYUGP) IN FORESTRY

(2024 Admission onwards)

Foreword

The Four-Year Undergraduate Programme (FYUGP) in Forestry is undergoing significant changes to better meet the needs of students, industries, and society. Education is seen as vital, and it's essential that the courses offered reflect the demands of the modern world. This means regularly updating the curriculum to keep pace with changes in society and the economy.

It is crucial for higher education to equip students with practical skills that are directly relevant to their chosen fields. However, despite the increasing number of people attending college, there are concerns about whether the education they receive adequately prepares them for the workforce. This is particularly true when it comes to skills that employers are looking for.

As our world becomes more interconnected and fast-paced, it's essential for educational institutions to evolve and teach students the skills they need to succeed in the 21st century. This includes not only technical skills but also critical thinking, communication, and adaptability. In the field of forestry, there is an urgent need to focus on forest conservation, biodiversity preservation, and sustainable management of forest resources. The curriculum must address these critical issues to prepare students to tackle the environmental challenges of our time. Topics such as ecosystem services, climate change mitigation, and the socio-economic aspects of forest management are essential components of a modern forestry education.

The government of Kerala is taking proactive steps to improve higher education by setting up commissions to recommend changes to policies, regulations, and evaluation systems. These efforts include a focus on integrating forest conservation principles into the educational framework.

As part of these efforts, the undergraduate curriculum, including the FYUGP in Forestry, is being restructured to better align with the goals of creating a knowledgeable society capable of driving sustainable development. These changes aim to ensure that higher education remains relevant and beneficial for both students and society as a whole, fostering a new generation of forestry professionals equipped to protect and manage our vital forest resources.

Aneesh K S,
Chairperson,
BoS, UG Forestry

Preamble

Welcome to the Four-Year Undergraduate Programme (FYUGP) in BSc Forestry at Kannur University. This syllabus has been carefully crafted to provide students with a comprehensive understanding of the vital field of forestry while equipping them with the necessary skills to thrive in today's dynamic environment.

Forestry, the science and art of managing forests, trees, and related natural resources, is a field of immense importance for ecological balance, biodiversity conservation, and sustainable development. As we witness rapid advancements in science and technology, the study of forestry continues to evolve, presenting new opportunities and challenges.

This syllabus aims to blend theoretical knowledge with practical applications, offering students a well-rounded education that prepares them for both academic pursuits and professional endeavours. Through a combination of classroom lectures, laboratory experiments, fieldwork, and research projects, students will delve deep into the intricate world of forest biology, exploring topics such as forest ecology, silviculture, forest management, conservation biology, wildlife management, and environmental policy.

At Kannur University, we are committed to providing our students with a stimulating learning environment that fosters curiosity, critical thinking, and a passion for discovery. We encourage active participation, independent thinking, and collaborative learning, ensuring that our graduates emerge as confident and competent individuals ready to make meaningful contributions to society.

This syllabus represents our dedication to academic excellence, innovation, and continuous improvement. We believe that by nurturing a deep appreciation for forests and natural resources and instilling a sense of responsibility towards environmental stewardship, our students will become future leaders who can address the pressing challenges facing our planet, including climate change, deforestation, and biodiversity loss.

We extend our best wishes to all students embarking on this educational journey and trust that their time spent studying forestry at Kannur University will be enriching, rewarding, and transformative.

KANNUR UNIVERSITY

Vision and Mission Statements

Vision: To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasaragod and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission:

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive lues as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavours.
- To affiliate colleges and other institutions of higher learning and to monitor academic ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as nongovernmental organizations for continuing education and also for building public awareness on important social, cultural, and other policy issues.

BOARD OF STUDIES - FORESTRY (UG)

Chairperson		
1	Aneesh K S	Assistant Professor, Department of Forest Resource Management, College of forestry, Vellanikkara, KAU.
Members		
2	Aparna P	Assistant Professor, Department of Botany, Sree Narayana College, Kannur.
3	Resmi P Thomas	Assistant Professor, Department of Botany, Sree Narayana College, Kannur.
4	Malik Fasil M	Assistant Professor, Department of Wildlife Science, College of forestry, Vellanikkara, KAU.
5	Dr. Ganesh Gopal T M	Assistant Professor, Department of Wood Science and Technology, Mangattuparamba Campus, Kannur University.
6	Dr. Manoj K	Assistant Professor, Department of Environmental Studies, Mangattuparamba Campus, Kannur University.
7	Dr. P Balakrishnan Peroth	Sr. Scientist, Department of Wildlife Biology, Kerala Forest Research Institute, Thrissur.
8	Dr.Amruth M	Sr. Scientist, Department of Sociology, Kerala Forest Research Institute, Thrissur.
9	Dr. Santhosh Sreevihar	Assistant Professor, Department of Zoology, Malab ar Christian College, Calicut.
10	Dr. Suresh V	Assistant Professor, Department of Botany, Govt. Victoria College, Palakkad
11	Dr. Sreenivasan E	Industrial Expert, Head R & D, The western India Plywood Ltd.
Special Invitees		
12	Sneha C,	Assistant Professor, Department of Forestry, Sir Syed College, Taliparamba
13	Azhar Ali A	Assistant Professor, Department of Forestry, Sir Syed College, Taliparamba

FYUGP BSc FORESTRY ADHOC COMMITTE

1	Prof. S Sudheesh (Chairperson)	Dean, Faculty of Science
2	Sneha C, (Convener)	Assistant Professor, Department of Forestry, Sir Syed College, Taliparamba
3	Aneesh K S	Assistant Professor, Department of Forest Resource Management, College of forestry, Vellanikkara, KAU.
4	Malik Fasil M	Assistant Professor, Department of Wildlife Science, College of forestry, Vellanikkara, KAU.
5	Azhar Ali A	Assistant Professor, Department of Forestry, Sir Syed College, Taliparamba
6	Dr. Ganesh Gopal T M	Assistant Professor, Department of Wood Science and Technology, Mangattuparamba Campus, Kannur University.
7	Dr. Manoj K	Assistant Professor, Department of Environmental Studies, Mangattuparamba Campus, Kannur University.
8	Dr. P Balakrishnan Peroth	Sr. Scientist, Department of Wildlife Biology, KFRI, Thrissur.
9	Dr.Amruth M	Sr. Scientist, Department of Sociology, KFRI, Thrissur.
10	Dr. Santhosh Sreevihar	Assistant Professor, Department of Zoology, Malabar Christian College, Calicut.
11	Dr. Suresh V	Assistant Professor, Department of Botany, Govt. Victoria College, Palakkad

KANNUR UNIVERSITY

UG PROGRAMME OUTCOMES (PO)

PO1	Critical Thinking
1.1	Acquire the ability to apply the basic tenets of logic and science to thoughts, actions, and interventions.
1.2	Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.
1.3	Develop self-critical abilities and also the ability to view positions, problems, and social issues from plural perspectives.
PO2	**Effective Citizenship**
2.1	Learn to participate in nation-building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy, and the values that guide a republic.
2.2	Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalization and the ability to understand and resist various kinds of discrimination.
2.3	Internalize certain highlights of the nation's and region's history. Especially of the freedom movement, the renaissance within native societies and the project of modernization of the postcolonial society.
PO3	**Effective Communication**
3.1	Acquire the ability to speak, write, read, and listen clearly in person and through electronic media in both English and in one Modern Indian Language
3.2	Learn to articulate, analyse, synthesise, and evaluate ideas and situations in a well-informed manner.
3.3	Generate hypotheses and articulate assent or dissent by employing both reason and creative thinking.
PO4	**Interdisciplinarity**
4.1	Perceive knowledge as an organic, comprehensive, interrelated, and integrated faculty of the human mind
4.2	Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.
4.3	Develop aesthetic, social, humanistic, and artistic sensibilities for problem solving and evolving a comprehensive perspective

FYUGP IN FORESTRY

PROGRAMME SPECIFIC OUTCOMES (PSOS)

After successful completion of four-year UG programme in Forestry, a student should be able to:

PS0 1	Demonstrate a deep understanding of forest ecosystems, including the interactions between biotic and abiotic components, ecological succession, and the role of forests in global biogeochemical cycles.
PSO 2	Implement and manage sustainable forestry practices, ensuring the balance between economic, ecological, and social values in forest resource utilization and conservation.
PS0 3	Utilize advanced tools and technologies such as Geographic Information Systems (GIS), remote sensing, and drone technology for forest inventory, mapping, monitoring, and management.
PSO 4	Plan and execute wildlife management and habitat conservation strategies, ensuring the protection and restoration of biodiversity within forest ecosystems.
PS0 5	Engage in participatory approaches to forestry that involve local communities, fostering collaboration and integrating traditional knowledge with scientific practices for sustainable forest management.
PSO 6	Effectively communicate forestry-related issues to diverse audiences, advocating for sustainable forestry practices and raising awareness about the importance of forests in addressing environmental and societal challenges.
PS0 7	Promote a sense of environmental stewardship, fostering a positive vision for utilizing forests to combat global challenges, including climate change.

BSc FORESTRY (MAJOR) PATHWAY COURSES

Sl. No.	Level	Course Code	Sem	Name of the course	Credit	ESE	CE	PRACT	TOTAL
1st YEAR BSc FORESTRY									
I SEMESTER									
1	100-199	KU1DSCFOR101	1	Forest and Forest Ecology	3 +1	50	25	25	100
II SEMESTER									
2	100-199	KU2DSCFOR105	2	Principles and Practices of Silviculture	3+ 1	50	25	25	100
2nd YEAR BSc FORESTRY									
III SEMESTER									
3	200-299	KU3DSCFOR201	3	Tree Physiology	3 + 1	50	25	25	100
4	200-299	KU3DSCFOR202	3	Wood Structure and Functions	4	70	30	0	100
IV SEMESTER									
5	200-299	KU4DSCFOR206	4	Forest Utilization	3 + 1	50	25	25	100
6	200-299	KU4DSCFOR207	4	Wildlife Management and Conservation Biology	3 + 1	50	25	25	100
7	200-299	KU4DSCFOR208	4	Forest Genetics and Biotechnology	3+ 1	50	25	25	100
3rd YEAR BSc FORESTRY									
V SEMESTER									
Sl. No.	**Level**	**Course Code**	**Sem**	**Name of the course**	**credit**	**ESE**	**CE**	**PRACT**	**TOTAL**
8	300-399	KU5DSCFOR301	5	Soil Science	3+ 1	50	25	25	100
9	300-399	KU5DSCFOR302	5	Forest Health and Protection	3+ 1	50	25	25	100
10	300-399	KU5DSCFOR303	5	Agroforestry, Social Forestry and Human Dimension	4	70	30	0	100

11	300-399	KU5DSEFOR304	5	*Wildlife Monitoring Techniques*	4	70	30	0	100
12	300-399	KU5DSEFOR305	5	*Vegetation Analysis and Biodiversity Assessment*	4	70	30	0	100
13	300-399	KU5DSEFOR306	5	*Forest Mensuration*	4	70	30	0	100
14	300-399	KU5DSEFOR307	5	*Forest Tree Breeding*	4	70	30	0	100
VI SEMESTER									
15	300-399	KU6DSCFOR309	6	Seed Technology	3 + 1	50	25	25	100
16	300-399	KU6DSCFOR310	6	Forest Economics and Elementary Statistics	3+ 1	50	25	25	100
17	300-399	KU6DSCFOR311	6	Forest Management and Plantation Forestry	4	70	30	0	100
18	300-399	KU6DSEFOR312	6	*Wood Defects, Degradation and Preservation*	4	70	30	0	100
19	300-399	KU6DSEFOR313	6	*Certification of Forest Products*	4	70	30	0	100
20	300-399	KU6DSEFOR314	6	*Silviculture of Indian Trees*	4	70	30	0	100
21	300-399	KU6DSEFOR315	6	*Forest Survey and Geoinformatics*	4	70	30	0	100
22	300-399	KU6INTFOR317	6	Internship/apprenticeship/ FFE / Nature Camp	2	35	15	0	50
4th YEAR BSc FORESTRY									
VII SEMESTER									
Sl. No.	**Level**	**Course Code**	**Sem**	**Name of the course**	**credit**	**ESE**	**CE**	**PRACT**	**TOTAL**
23	400-499	KU7DCCFOR401	7	Microbiology for Forestry	3+ 1	50	25	25	100
24	400-499	KU7DCCFOR402	7	Forest Hydrology and Watershed Management	4	70	30	0	100
25	400-499	KU7DCCFOR403	7	Wood based Industries	4	70	30	0	100
26	400-499	KU7DCCFOR404	7	Environmental Impact Assessment and Auditing	4	70	30	0	100

27	400-499	KU7DCCFOR405	7	Forest Stand Dynamics	4	70	30	0	100
VIII SEMESTER									
28	400-499	KU8DCCFOR406	8	Tree Breeding and Advanced Propagation Techniques	3+ 1	50	25	25	100
29	400-499	KU8DCCFOR407	8	Environmental legislation and Management	3+ 1	50	25	25	100
30	400-499	KU8DCCFOR408	8	Climate Change and Disaster Management	3+ 1	50	25	25	100
31	400-499	KU8DCEFOR409	8	*Advanced Bioinformatics*	3+ 1	50	25	25	100
32	400-499	KU8DCEFOR410	8	*Ecological modelling*	3+ 1	50	25	25	100
33	400-499	KU8DCEFOR411	8	*R programming*	3+ 1	50	25	25	100
34	400-499	KU8DCEFOR412	8	*Biostatistics*	3+ 1	50	25	25	100
35	400-499	KU8DCEFOR413	8	*Research Methodology*	3+ 1	50	25	25	100
36	400-499	KU8DCEFOR414	8	*Scientific Writing*	3+ 1	50	25	25	100
37	400-499	KU8DCEFOR415	8	*Global Change Ecology*	3+ 1	50	25	25	100
38	400-499	KU8DCEFOR416	8	*Wood variation*	3+ 1	50	25	25	100
39	400-499	KU8DCEFOR417	8	*Biometrical Genetics*	3+ 1	50	25	25	100
40	PROJECT	KU8PRJFOR426	8	Project	8	140	60	--	200
41	PROJECT	KU8PRJFOR427	8	Project	12	210	90	--	300

BSc FORESTRY (MINOR) PATHWAY COURSES

Sl. No.	Level	Course Code	Sem	Name of the course	credit	ESE	CE	PRACT	TOTAL
I SEMESTER									
42	100-199	KU1DSCFOR102	1	Introduction to Forest Resources	3 + 1	50	25	25	100
43	100-199	KU1DSCFOR103	1	Introduction to Wildlife Sciences	3 + 1	50	25	25	100
II SEMESTER									
44	100-199	KU2DSCFOR106	2	Forest Botany	3 + 1	50	25	25	100
45	100-199	KU2DSCFOR107	2	Field Ornithology and Bird Watching	3 + 1	50	25	25	100
III SEMESTER									
46	200-299	KU3DSCFOR203	3	Introduction to Agroforestry	3 + 1	50	25	25	100
47	200-299	KU3DSCFOR204	3	Wildlife Management	3 + 1	50	25	25	100
VIII SEMESTER									
48	300-399	KU8DSEFOR418	8	*Ethnobiology and Intellectual Property Rights*	3+ 1	50	25	25	100
49	300-399	KU8DSEFOR419	8	*Entrepreneurial Forestry*	3+ 1	50	25	25	100
50	300-399	KU8DSEFOR420	8	*Green technology and Sustainable Development*	3+ 1	50	25	25	100
51	300-399	KU8DSEFOR421	8	*Remote Sensing and GIS*	3+ 1	50	25	25	100
52	300-399	KU8DSEFOR422	8	*Medicinal and Aromatic Plants*	3+ 1	50	25	25	100
53	300-399	KU8DSEFOR423	8	*Zoonotic Disease Management*	3+ 1	50	25	25	100
54	300-399	KU8DSEFOR424	8	*Biochemistry*	3+ 1	50	25	25	100
55	300-399	KU8DSEFOR425	8	*Instrumentation and Biological Techniques*	3+ 1	50	25	25	100

VALUE ADDITION AND SKILL ENHANCEMENT COURSES

Sl. No.	Course Code	Name of the course	credit	ESE	CE	PRACT	TOTAL
VAC							
56	KU3VACFOR220	Basic Life Support Skills and First Aid	3	65	35		100
57	KU3VACFOR221	Field Etiquettes in Forestry	3	65	35		100
58	KU4VACFOR222	Civic Education	3	65	35		100
59	KU4VACFOR223	Towards Environmental Stewardship	3	65	35		100
60	KU4VACFOR224	Citizen Science in Conservation	3	65	35		100
61	KU4VACFOR225	Bioethics and IPR	3	65	35		100
SEC							
62	KU4SECFOR230	Dendrology	3	65	35		100
63	KU4SECFOR231	Ornithology	3	65	35		100
64	KU4SECFOR232	Herpetology	3	65	35		100
65	KU4SECFOR233	Forest Biometry	3	65	35		100
66	KU5SECFOR330	Introduction to IT	3	65	35		100
67	KU5SECFOR331	Indoor Plantscaping	3	65	35		100
68	KU5SECFOR332	Urban Greenscaping	3	65	35		100
69	KU5SECFOR333	Commercial Bee Keeping	3	65	35		100
70	KU6SECFOR334	Drone Application in Natural Resource Management	3	65	35		100
71	KU6SECFOR335	Conservation photography	3	65	35		100
72	KU6SECFOR336	IOT in Plant Nursery Automation	3	65	35		100
73	KU6SECFOR337	Woodworking and Finishing Techniques	3	65	35		100

SYLLABUS INDEX

Name of the Major: **Forestry**

SEMESTER I								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU1DSCFOR101	Forest and Forest Ecology	DSC A	4	5	3		2	
KU1DSCFOR102	Introduction to Forest Resources	DSC B	4	5	3		2	
KU1DSCFOR103	Introduction to Wildlife Sciences	DSC C	4	5	3		2	
KU1MDCFOR104	Ecotourism	MDC 1	3	4	3		0	
		AEC 1 (E)	3	3	3		0	
		AEC 2 (L)	3	3	3		0	
SEMESTER II								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU2DSCFOR105	Principles and Practices of Silviculture	DSC A	4	5	3		2	
KU2DSCFOR106	Forest Botany	DSC B	4	5	3		2	
KU2DSCFOR107	Field Ornithology and Bird Watching	DSC C	4	5	3		2	

KU2MDCFOR108	Wildlife Photography	MDC 2	3	3	3		0	
		AEC 1 (E)	3	3	3		0	
		AEC 2 (L)	3	3	3		0	
SEMESTER III								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU3DSCFOR201	Tree Physiology	DSC A	4	5	3		2	
KU3DSCFOR202	Wood Structure and Functions	DSC A	4	4	4		0	
KU3DSCFOR203	Introduction to Agroforestry	DSC B	4	5	3		2	
KU3DSCFOR204	Wildlife Management	DSC C	4	5	3		2	
KU3VACFOR220	Basic Life Support Skills and First Aid	VAC *(Any one)*	3	3	3		0	
KU3VACFOR221	Field Etiquettes in Forestry							
	MDC 3 in Kerala specific content shall be offered by language disciplines only	MDC 3	3	3	3		0	
SEMESTER IV								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU4DSCFOR206	Forest Utilization	DSC A	4	5	3		2	

KU4DSCFOR207	Wildlife Management and Conservation Biology	DSC A	4	5	3		2	
KU4DSCFOR208	Forest Genetics and Biotechnology	DSC A	4	5	3		2	
KU4VACFOR222	Civic Education	VAC *(Any one)*	3	3	3		0	
KU4VACFOR223	Towards Environmental Stewardship							
KU4VACFOR224	Citizen Science in Conservation	VAC *(Any one)*	3	3	3		0	
KU4VACFOR225	Bioethics and IPR							
KU4SECFOR230	Dendrology	SEC *(Any one)*	3	3	3		0	
KU4SECFOR231	Ornithology							
KU4SECFOR232	Herpetology							
KU4SECFOR233	Forest Biometry							
SEMESTER V								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU5DSCFOR301	Soil Science	DSC A	4	5	3		2	
KU5DSCFOR302	Forest Health and Protection	DSC A	4	5	3		2	
KU5DSCFOR303	Agroforestry, Social Forestry and Human dimension	DSC A	4	4	4			
KU5DSEFOR304	*Wildlife Monitoring Techniques*	DSE 1	4	4	4			
KU5DSEFOR305	*Vegetation Analysis and Biodiversity Assessment*		4	4	4			
KU5DSEFOR306	*Forest Mensuration*	DSE 2	4	4	4			

KU5DSEFOR307	*Forest Tree Breeding*		4	4	4			
KU5SECFOR330	Introduction to IT	SEC *(Any one)*	3	3	3			
KU5SECFOR331	Indoor Plantscaping							
KU5SECFOR332	Urban Greenscaping							
KU5SECFOR333	Commercial Bee Keeping							
SEMESTER VI								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU6DSCFOR309	Seed Technology	DSC A	4	5	3		2	
KU6DSCFOR310	Forest Economics and Elementary Statistics	DSC A	4	5	3		2	
KU6DSCFOR311	Forest Management and Plantation Forestry	DSC A	4	4	4		0	
KU6DSEFOR312	*Wood Defects, Degradation and Preservation*	DSE 3	4	4	4		0	
KU6DSEFOR313	*Certification of Forest Products*		4	4	4		0	
KU6DSEFOR314	*Silviculture of Indian Trees*	DSE 4	4	4	4		0	
KU6DSEFOR315	*Forest Survey and Geoinformatics*		4	4	4		0	
KU6SECFOR334	Drone Application in Natural Resource Management	SEC *(Any one)*	3	3	3		0	
KU6SECFOR335	Conservation photography							
KU6SECFOR336	IOT in Plant Nursery Automation							
KU6SECFOR337	Woodworking and Finishing Techniques							
KU6INTFOR317	Intern/apprentice/FFE /Nature Camp		2				2	

SEMESTER VII								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU7DCCFOR401	Microbiology for Forestry	DCC	4	5	3		2	
KU7DCCFOR402	Forest Hydrology and Watershed Management	DCC	4	4	4		0	
KU7DCCFOR403	Wood based Industries	DCC	4	4	4		0	
KU7DCCFOR404	Environmental Impact Assessment and Auditing	DCC	4	4	4		0	
KU7DCCFOR405	Forest Stand Dynamics	DCC	4	4	4		0	
SEMESTER VIII								
Course Code	**Title of the Course**	**Type of the Course DSC, MDC, SEC etc.**	**Credit**	**Hours /week**	**Hour Distribution**			
					L	**T**	**P**	**O**
KU8DCCFOR406	Tree Breeding and Advanced Propagation Techniques	DCC	4	5	3		2	
KU8DCCFOR407	Environmental legislation and Management	DCC	4	5	3		2	
KU8DCCFOR408	Climate Change and Disaster Management	DCC	4	5	3		2	
KU8DCEFOR409	*Advanced Bioinformatics*	DCE	4	5	3		2	
KU8DCEFOR410	*Ecological modelling*		4	5	3		2	

KU8DCEFOR411	*R programming*		4	5	3		2	
KU8DCEFOR412	*Biostatistics*	DCE	4	5	3		2	
KU8DCEFOR413	*Research Methodology*		4	5	3		2	
KU8DCEFOR414	*Scientific Writing*		4	5	3		2	
KU8DCEFOR415	*Global Change Ecology*	DCE	4	5	3		2	
KU8DCEFOR416	*Wood variation*		4	5	3		2	
KU8DCEFOR417	*Biometrical Genetics*		4	5	3		2	
KU8DSEFOR418	*Ethnobiology and Intellectual Property Rights*	DSE *(For Minor Pathway)*	4	5	3		2	
KU8DSEFOR419	*Entrepreneurial Forestry*		4	5	3		2	
KU8DSEFOR420	*Green technology and Sustainable Development*	DSE *(For Minor Pathway)*	4	5	3		2	
KU8DSEFOR421	*Remote Sensing and GIS*		4	5	3		2	
KU8DSEFOR422	*Medicinal and Aromatic Plants*	DSE *(For Minor Pathway)*	4	5	3		2	
KU8DSEFOR423	*Zoonotic Disease Management*		4	5	3		2	
KU8DSEFOR424	*Biochemistry*	DSE *(For Minor Pathway)*	4	5	3		2	
KU8DSEFOR425	*Instrumentation and Biological Techniques*		4	5	3		2	

KU8PRJFOR426	*PROJECT*	8 Credit						
KU8PRJFOR427		12 Credit						

DSC - Discipline Specific Pathway components (Major/Minor); DSE - Discipline Specific Pathway components (Elective); DCC - Discipline Specific Capstone Components; DCE - Discipline Specific Capstone Components (Elective); AEC - Ability Enhancement courses; SEC - Skill Enhancement Courses; VAC - Value Addition Courses; MDC - Multi-disciplinary Courses.

Course Distribution for Students in the Fourth Year of KUFYUGP

(i) Three PG level core courses (level 400 & above) in the Major discipline (for Honours); or (ii) Combination of Major core courses of level 400 & project up to 12 credits in the Major discipline (for Honours); or (iii) One 12-credit Research Project in the Major discipline (for Honours with Research) (iv) In the case of Honours students who go to another institution for doing the Project, the remaining Major core course can be in the online mode or in the in-person mode from the institution where the Project is being done. ***AND*** *(i) Three Minor Pathway Courses of level 300 & above / level 400 & above; or (ii) Three Elective Courses in Major discipline of level 400 & above; or (iii) Two courses in Minor discipline + One course in Major / any other discipline; or (iv) Three Courses in any other discipline of level 300 & above / level 400 & above; or (v) Two courses in Major / Minor / any other discipline + One course in research methodology (vi) Two of these courses can be in the online mode. These online courses can be taken either in semester VII or in semester VIII, but their credits shall be added to the student's account only in semester VIII. (vii) For those students who go to another institution for doing the Project, all these three courses can be in the online mode or in the in-person mode from the institution where the Project is being done.*

GENERAL RULES

ELIGIBILITY FOR ADMISSION AND SELECTION OF COURSES

Admission, enrollment, registration, options for changing major programs, selection of academic pathways, readmission and scheme migration, assessment and evaluation, and final grading and awarding of degrees are based on the Kannur University FYUGP Regulations and Curriculum Framework 2024, as well as the norms and rules established by the Government and the University from time to time.

Students must have completed the examination conducted by a recognized Board or University at the +2 level of schooling or its equivalent.

Departments will provide information on the courses they offer, including the eligibility criteria.

At the end of the second semester, students may be permitted to change their major program of study. Based on the availability of seats and infrastructure facilities, students may opt for any discipline they studied during the first two semesters as discipline-specific foundation courses or multidisciplinary foundation courses. If a student switches their major to a discipline in which an MDC has been completed, they will have to undertake additional DSC courses in the new discipline to acquire the required minimum credits.

One course should be offered by a faculty member whenever possible. The faculty member shall inform the students about the outcomes, course plan, and assessment methods at the beginning of the course.

Module 5 of each course is designated as 'Teach Space'—a personal, flexible, and dynamic area for teaching activities tailored to the needs of the instructor, infrastructure, course outcome, and the requirements of the students.

Students are advised to select a variety of courses from the available options instead of choosing courses with similar content. Some professional courses and jobs require a Botany major along with minors in Chemistry and Zoology. Therefore, students should carefully consider their selection of major and minor courses.

SWAYAM, MOOC, or other online courses can be selected from the course offerings of Indian universities and institutes. These courses must be related to the student's major and can be used to earn credits. Students can opt for SWAYAM and other online courses to earn credits, provided they complete an internal viva, give a presentation, and submit a report on the course.

SUGGESTED PEDAGOGY AND EVALUATION

Teaching-Learning

The FYUGP program is based on Outcome-Based Education (OBE). To achieve the desired outcomes in each course, various methods of teaching, learning, and evaluation are employed. Credit earning and transfer follow the guidelines of the Kannur University FYUGP regulations and curriculum framework of 2024.

Types of Teaching and Learning Activities

Types of Course	Teacher Activity	Student Activity
Theory	Lectures, demonstrations, presentations, discussions, and debates	Review of literature, assignments, presentations, e-learning, discussions, and debates with peers, teachers, and experts.
Practical	Demonstrations, experimentation, field visits, and certification	Identification, comparison, differentiation, and categorization of different plants and their parts using permanent slides and hand sectioning. Additionally, demonstration, experimentation, field visits, report writing, and record keeping
Field Study/Study Tour	For plant diversity and technological studies, experiential learning should complement theoretical learning. Faculty members guide this flexible activity, determining the field for the trip.	Students should observe the features from the field and document peculiarities and diversity in a report.

Internship

Each student must complete an internship within the six semesters to engage with practical aspects of their learning and enhance employability. A report is required by the end of the sixth semester. The internship must last a minimum of 60 working hours and can be on-campus or off-campus, potentially consisting of 1-3 accumulated activities. Off-campus internships require prior approval, and an attendance certificate must be submitted to the HoD upon rejoining. HoDs ensure completion of the internship.

Suggested Internships: Summer internships at biology institutes or local industries related to botany/ecology/agriculture, field trips to various ecosystems or nature camps, apprenticeships in NGOs or relevant industries, and social responsibility activities such as river restoration, PBR preparation, landscaping, and green auditing.

Student Responsibilities: Selecting the internship topic/activity, discussing with a mentor, planning and execution, and preparing and presenting the report.

Teacher/Supervising Guide Responsibilities: Confirming the topic/activity, providing guidance, and correcting and certifying the prepared report.

Mandatory/Optional Project

In the eighth semester, a mandatory 12-credit project (minimum 360 working hours) is required for FYUGP research or honors, or an optional 8-credit project (minimum 240 working hours) alongside a major theory course. Project guidance can be provided by a faculty member of the department. If necessary, the expertise of an external guide may be utilized. Facilities and expertise for the project can be on-campus or off-campus, with required

permissions for off-campus projects. Students must maintain and submit a project logbook/register along with the final report.

Student Responsibilities: Suggesting the topic, discussing with the project guide and peers, reviewing literature, planning and designing the project, experimentation, data analysis, and preparing and presenting the project report.

Teacher/Supervising Guide Responsibilities: Confirming the topic, demonstrating, planning experimentation, providing guidance, and correcting and certifying the project.

Evaluation

Each student should go through the evaluation process in an indirect grading method, as per the Kannur University FYUGP- regulations and curriculum framework. - 2024. The evaluation for the odd semesters and the practical components will be done by the college itself and that for even semesters will be conducted at the university level.

Regarding evaluation, one-credit courses will be assessed for 25 marks, two-credit courses for 50 marks, three-credit courses for 75 marks, and four-credit courses for 100 marks. A copy of all records of evaluation shall be maintained in the department/college and should be available for verification by the university/BoS / the student.

EVALUATION	WEIGHTAGE
END SEMESTER EVALUATION- ESE	70
CONTINUOUS COMPREHENSIVE ASSESSMENT - CCA	30

The CCA component has two parts Formative Assessment (FA) and Summative Assessment (SA) with an equal weightage. The components of Evaluation will be determined by the instructor/faculty and the same will be communicated to the student at the beginning of the course.

Suggestive Methods of Formative Assessment (FA)

Formative assessment methods may include assignments (both theory and practical), viva voce, quizzes, interviews, presentations, classroom discussions, observation of practical skills, and self and peer assessments. The course coordinator or faculty member will determine the combination of these tools and their respective weightages and will communicate this information to the students at the beginning of the course.

Suggestive Methods of Summative Assessment (SA)

FA methods may include written tests, open-book tests, laboratory records or reports, project reports, and case study reports. The coordinator can decide on the combination and relative weightage of these tools, which should be communicated to the students at the beginning of each course.

Evaluation of Theory Courses

End Semester Examinations will be held in October for odd semesters and in March for even semesters. A 3-credit theory course will be evaluated with a 50-mark question paper, with a duration of 1.5 hours. A 4-credit theory course will be evaluated with a 70-mark

question paper, with a duration of 2 hours.

A copy of all records of evaluation shall be maintained by course in charge or the faculty for verification by the HoD / the student.

Evaluation of Practical Courses

Students must attend the practical classes and go through the continuous evaluation process for the course. Only those who have completed the continuous evaluation will be permitted to appear for the end-semester (practical) viva-voce. A copy of all records of evaluation shall be maintained by course in charge or the faculty for verification by the HoD / the student.

The end-semester practical examination, viva-voce, and evaluation of practical records shall be conducted by the course in-charge and an internal examiner appointed by the Department Council. The Continuous Comprehensive Assessment (CCA) of practical courses shall be conducted by the course incharge. For courses with both theory and practical components, the CCA components: The continuous evaluation of practical courses shall be completed at least 10 days before the start of the end-semester examination.

EVALUATION	WEIGHTAGE
END SEMESTER EVALUATION- ESE	60
CONTINUOUS COMPREHENSIVE ASSESSMENT - CCA	40

Internship

The components of internship evaluation include performance evaluation, attendance and participation, the quality of the internship report, and the effectiveness of the presentation. Additional components are the viva voce examination, feedback from the internship site, self-assessment, and, if applicable, peer assessment. Continuous Comprehensive Assessment (CCA) will be conducted by the faculty in charge, while the End Semester Examination will be evaluated by the Department Council, excluding the faculty in charge.

Components of Evaluation of Internship	Weightage Marks	Marks for Internship 2 Credit/50
Continuous Comprehensive Assessment (CCA)	30%	15 (Report 5, Viva 5, Presentation 5)
End Semester Evaluation (ESE)	70%	35

Evaluation of Project

A student pursuing UG Honors with research must complete a mandatory research project worth 12 credits by the end of the eighth semester. For other UG Honors students, the project is optional. Since each credit corresponds to 25 marks, the 12-credit project will be evaluated for a total of 300 marks. The evaluation scheme for the project is detailed below:

Project type	Maximum Marks	CCA (30%)	ESE (70%)
Research Project of 12 Credits	300	90 Pre synopsis presentation and viva Review of literature Regularity and Participation (1:1:1)	210 Report, Methodology, Social Relevance, Scientific accuracy, innovation, data analysis, presentation skill, viva (components and their relative weightage can be decided by the department council)
Research Project of 8 Credits	200	60 Pre synopsis presentation and viva Review of literature Regularity and Participation (1:1:1)	140 Report, Methodology, Social Relevance, Scientific accuracy, innovation, data analysis, presentation skill, viva (components and their relative weightage can be decided by the department council)

Grading

Marks obtained in each component or question of a course are converted into a 10-point indirect grading system. The Semester Grade Point Average (SGPA) is calculated from these grades to evaluate student performance each semester. The Cumulative Grade Point Average (CGPA) and the corresponding grading scale are outlined below.

Sl. No	Percentage of Marks (ESE and CCA put together)	Description	Letter Grade	Grade Point (P)	Range of Grade Points
1	95% and above	Outstanding	O	10	9.50 - 10
2	Above 85% and below 95 %	Excellent	A+	9	8.50-9.49
3	Above 75% to below 85%	Very Good	A	8	7.50-8.49
4	Above 65% to below 75%	Good	B+	7	6.50-7.49
5	Above 55% to below 65%	Above Average	B	6	5.50-6.49
6	Above 45% to below 55%	Average	C	5	4.50-5.49

7	Above 35% to below 45% (CCA and ESE put together) with a minimum of 30% in ESE.	Pass	P	4	3.50-4.49
8	Below an aggregate of 35% or below 30% in ESE	Fail	F	0	0-3.49
9	Not attending the examination	Absent	Ab	0	0

KU1DSCFOR101 FOREST AND FOREST ECOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCFOR101	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1		25	50	75	2
			Marks Distribution- Practical			
			10	15	25	

Course Description: This course offers an in-depth exploration of forests, forestry, and ecological principles, focusing on biomes, forest types, and their management. Students will examine the characteristics of various biomes, with special emphasis on forest ecosystems. The course also delves into the historical and contemporary aspects of forestry, particularly in India and Kerala, and covers ecological principles and succession theories relevant to forest management. Through theoretical learning and practical exercises, students will gain a comprehensive understanding of forest ecology, biodiversity, and sustainable management practices.

Course Prerequisite

- Basic knowledge in Ecology at 10th level, Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Explain the various definitions and classifications of forests based on regeneration methods, age, composition, management objectives, growing stock, ownership, and legal status.	***U***
2	Apply classification systems, such as Champion & Seth's revised classification, to identify forest types in India and Kerala.	***A***

3	Analyze the structure and function of forest ecosystems, including energy flow, nutrient cycling, and succession processes.	***An***
4	Assess the impact of global climate change on forests and the role of forests in carbon sequestration and climate change mitigation.	***E***
5	Develop sustainable forest management and conservation strategies that consider both local and global contexts.	***©***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create ©***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔			✔			
CO 2			✔				
CO 3	✔					✔	
CO 4							✔
CO 5		✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: INTRODUCTION TO WORLD FORESTS (10 Hours)**	
	1	Biomes of the world- Biotic and abiotic characteristics
		a) Tundra

		b) Temperate Coniferous Forests
		c) Deciduous Forests
		d) Tropical Rain Forests
		e) Grasslands
		f) Deserts
		g) Water biomes
	2	Temperate and Tropical Forests- Comparison
	3	Forest: various definitions
	4	Classification of forests based on
		a) Method of regeneration
		b) Age
		c) Composition
		d) Objects of management
		e) Growing stock
		f) Ownership
		g) Legal status
2	**MODULE TITLE: FORESTRY AND STATE OF FOREST (15 Hours)**	
	1	Definition, History, and Development of Indian Forestry
	2	Branches of Forestry and their relationships
	3	Forest types in India and Kerala: systems of classification
	4	State of the forests: global, Indian, and Kerala scenario
	5	Distribution, species composition, and characteristic features of forests with special reference to Kerala

		a) Evergreen forests
		b) Deciduous forests
		c) Shola forests
		d) Mangroves
		e) Myristica swamp forests
3	**MODULE TITLE: BASICS OF ECOLOGY (10 Hours)**	
	1	Levels of biological organization – abiotic and biotic components and their interaction.
	2	Trophic levels, food chains, ecological pyramids and energy flow.
	3	Forest Ecology – Forest ecosystem, structure and dynamics.
	4	Horizontal and vertical stratification.
	5	Formation of forest communities
		a) Consociation
		b) Association
4	**MODULE TITLE: Ecological Succession (10 Hours)**	
	1	Succession Types
		a) Primary and Secondary Succession
		b) Autogenic and Allogenic Succession
		c) Xerarch and Hydrarch
	2	Causes of succession
	3	Forest succession and climax vegetation types
	4	Succession theories

		a) Monoclimax
		b) Polyclimax
		c) Mosaic theory
	5	Models of succession
5	**Teacher Specific Module (30 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	5.1 Visit a local biome (e.g., a forest, grassland, or wetland) to observe and document biotic and abiotic factors. 5.2 Collect soil, water, and plant samples from different biomes for laboratory analysis of physical and chemical properties. 5.3 Use microscopes to examine soil microorganisms from different biomes. 5.4 Collect data on temperature, humidity, soil composition, and biodiversity from both temperate and tropical forests. 5.5 Assess species composition in different forest types using quadrat sampling. Space to fill the selected area/ activity	

Essential Readings:

1. Archibold, O.W., 2012. *Ecology of world vegetation*. Springer Science & Business Media.
2. Terborgh, J., 1985. The vertical component of plant species diversity in temperate and tropical forests. *The American Naturalist*, *126*(6), pp.760-776.
3. Khanna, L.S.1989. Principles and Practice of Silviculture. KhannaBandhu, Dehra Dun. 473 p
4. Negi, S.S., 1994. *Indian forestry through the ages*. Indus Publishing.
5. Parthiban, K.T., Krishnakumar, N. and Karthick, M., 2018. *Introduction to Forestry & Agroforestry*. Scientific Publishers.
6. **https://fsi.nic.in/**
7. Sundarapandian, S.M. and Swamy, P.S., 2000. Forest ecosystem structure and composition along an altitudinal gradient in the Western Ghats, South India. *Journal of tropical forest Science*, pp.104-123.

8. Simonetta, A.M., 2009. LEVELS OF BIOTIC ORGANIZATION. *BIOLOGICAL SCIENCE FUNDAMENTALS AND SYSTEMATICS-Volume I*, p.107.
9. Mishra, R. Ecology Work Book. Oxford and IBH Publishing Co, Calcutta.
10. Lal J. B. Forest Ecology. Natraj Publishers, Dehra Dun
11. Luken, J.O., 1990. *Directing ecological succession*. Springer Science & Business Media.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3
	4	3
2	1	4
	2	3
	3	5
	4	6
	5	7
3	1	8
	2	9
	3	10
	4	10
	5	10
4	1	11
	2	11
	3	11
	4	11
	5	11

Suggested Readings:

- Odum, E.P. 1983. Basic Ecology. Saunders College Publishing, Holt Saunders, Japan
- Odum, E.P. Fundamentals of Ecology. Natraj Publisher, Dehradun
- Misra KC. Manual of Plant Ecology. Oxford & IBH Pub Co. New Delhi etc. 491p
- Michael P. Ecological Methods for Field and Laboratory Investigations. Tata McGraw-Hill Pub.Co. New Delhi, 404p
- Frankel, O.H., Brown, A.H.D., Burdon, J.J. 1995. The Conservation of Plant Biodiversity. Cambridge University Press. Cambridge. 299p
- Negi, S.S. 1993. Biodiversity and its Conservation in India. India Publishing company, New Delhi
- Saggwal, S.S. 1995. Forest Ecology of India. Pioneer Publishers, India. 368p

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**
Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. Compare and contrast the abiotic factors of tundra and tropical rain forests.
2. Explain the main differences between temperate and tropical forests in terms of biodiversity and climate.
3. Apply Champion & Seth's classification to identify and describe the main forest types in Kerala.
4. Describe the characteristic features and species composition of Myristica swamp forests in Kerala.

6 Mark Questions

1. Analyze the structure and dynamics of a temperate forest ecosystem.
2. Explain the difference between consociation and association in the formation of forest communities.
3. Identify and discuss the primary causes of ecological succession in forests.
4. Compare and contrast monoclimax and polyclimax theories of succession.

14 Mark Questions

1. Develop a sustainable forest management strategy for a deciduous forest in India, considering both local and global contexts.
2. Assess the impact of global climate change on tropical rain forests and their role in carbon sequestration.

Employability for the Course:

- Environmental Educator
- Conservation Scientist
- Environmental Consultant
- Ecologist

KU1DSCFOR102 INTRODUCTION TO FOREST RESOURCES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
1	DSC	100-199	KU2DSCFOR102	4	75

<table>
<tr><td colspan="3">Learning Approach (Hours/ Week)</td><td colspan="3">Marks Distribution- Theory</td><td rowspan="2">Duration of ESE (Hours)</td></tr>
<tr><td>Lecture</td><td>Practical/ Internship</td><td>Tutorial</td><td>CE</td><td>ESE</td><td>Total</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">1</td><td rowspan="4"></td><td>25</td><td>50</td><td>75</td><td rowspan="4">2</td></tr>
<tr><td colspan="3">Marks Distribution- Practical</td></tr>
<tr><td>10</td><td>15</td><td>25</td></tr>
</table>

Course Description: Introduction to Forest Resources is a foundation course offering an in-depth examination of the ecological, social, and economic significance of forest ecosystems. Students will explore the multifaceted roles of forests in biodiversity conservation, climate regulation, and sustainable development while also addressing the myriad threats they face, including deforestation and habitat degradation. Through interdisciplinary study, students will learn about the principles and practices of sustainable forest management, conservation strategies, and the integration of indigenous knowledge systems. Emphasizing a holistic approach, the course will equip students with the knowledge and skills necessary to contribute to the preservation and responsible stewardship of forest resources on a global scale.

Course Prerequisite:

Basic knowledge in Biology at 10th level, Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Identify the key characteristics and distribution patterns of different forests	***R***
2	Apply knowledge of forest biomes to analyze and predict the distribution of specific species.	***A***

3	Analyze the interconnectedness of these ecological services and their importance for ecosystem health.	***An***
4	Evaluate the adaptive strategies of flora and fauna in evergreen and deciduous forests.	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔	✔			
CO 2	✔			✔			
CO 3	✔	✔					✔
CO 4	✔			✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: GENERAL INTRODUCTION TO WORLD FORESTS (15 Hours)**	
	1	World forests
		a) Distribution
		b) Classification
		c) Characteristics
	2	Temperate and Tropical Forests- Comparison
	3	Evergreen and Deciduous Forest

		a) Distribution
		b) species composition
		c) characteristic features
2	**MODULE TITLE: ROLE OF FORESTS (5 Hours)**	
	1	Direct benefits from forests
	2	Indirect benefits from forests
	3	Social and cultural values of forest
3	**MODULE TITLE: Threats to Forest Health (10 Hours)**	
	1	Deforestation
	2	Forest degradation
	3	Invasive species
	4	Pest and Disease
4	**MODULE TITLE: Conservation Strategies of Forest resources (15 Hours)**	
	1	Reserve Forest and Protected Area
	2	Conservation Strategies: National Perspectives
	3	Organization structure of Kerala Forest Department
5	**Teacher Specific Module (30 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	Space to fill the selected area/ activity	

Essential Readings:

1. Perry, D.A., Oren, R. and Hart, S.C., 2008. *Forest ecosystems*. JHU press.
2. Terborgh, J., 1985. The vertical component of plant species diversity in temperate and tropical forests. *The American Naturalist*, *126*(6), pp.760-776.
3. Bahuguna, V.K., Swaminath, M.H., Tripathi, S., Singh, T.P., Rawate, V.R.S. and Rawatf, R.S., 2016. Revisiting forest types of India. *International Forestry Review*, *18*(2), pp.135-145.
4. https://fsi.nic.in/forest-report-2021
5. Sills, E.O. and Abt, K.L. eds., 2003. *Forests in a market economy* (Vol. 72). Springer Science & Business Media.
6. Kettunen, M. and ten Brink, P. eds., 2013. *Social and economic benefits of protected areas: an assessment guide*. Routledge.
7. Hosonuma, N., Herold, M., De Sy, V., De Fries, R.S., Brockhaus, M., Verchot, L., Angelsen, A. and Romijn, E., 2012. An assessment of deforestation and forest degradation drivers in developing countries. *Environmental research letters*, *7*(4), p.044009.
8. Ciesta, W.M., 1998. Climate Change Forests and Forest Management: An Overview.
9. Simberloff, D., 2013. *Invasive species: what everyone needs to know*. Oxford University Press.
10. Tainter, F.H. and Baker, F.A., 1996. *Principles of forest pathology*. John Wiley & Sons.
11. Varghese, M.I., 2022. Treatise on Forest Laws in Kerala. Swamy Law House.
12. Babu, M.U. and Nautiyal, S., 2015. Conservation and management of forest resources in India: ancient and current perspectives. *Natural Resources*, *6*(4), pp.256-272.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3
	4	4
2	1	5
	2	6

	3	6
3	1	7
	2	8
	3	9,10
4	1	11
	2	12

Suggested Readings:

- Grebner, D.L., Bettinger, P., Siry, J.P. and Boston, K., 2021. *Introduction to forestry and natural resources*. Academic press.
- Sahana, M., Areendran, G., Raj, K., Sivadas, A., Abhijitha, C.S. and Ranjan, K., 2022. Introduction to Forest Resources in India: Conservation, Management and Monitoring Perspectives. In *Conservation, Management and Monitoring of Forest Resources in India* (pp. 3-31). Cham: Springer International Publishing.
- Banerjee, A., Jhariya, M.K., Yadav, D.K. and Raj, A. eds., 2020. *Environmental and sustainable development through forestry and other resources*. CRC press.
- Shit, P.K., Pourghasemi, H.R., Das, P. and Bhunia, G.S., 2020. *Spatial Modeling in Forest Resources Management*. Springer.
- Shit, P.K., Pourghasemi, H.R., Adhikary, P.P., Bhunia, G.S. and Sati, V.P. eds., 2021. *Forest resources resilience and conflicts*. Elsevier.
- Singh, M.P., Singh, J.K. and Mohanka, R., 2007. *Forest environment and biodiversity*. Daya Books.

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10

c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. What are the primary characteristics of tropical, temperate, and boreal forests?
2. Given a specific forest biome, predict the type of flora and fauna you would expect to find there and explain why.
3. Describe the differences in species diversity between tropical and temperate forests.
4. How does altitude affect the distribution and characteristics of forests?

6 Mark Questions

1. Discuss how biodiversity conservation in forests contributes to overall ecosystem health.
2. Analyze the relationship between soil conservation provided by forests and agricultural productivity in surrounding areas.
3. How does the availability of sunlight and water affect the distribution of species within a forest biome?

14 Mark Questions

1. Discuss how biodiversity conservation in forests contributes to overall ecosystem health.

2. Explain the role of forests in carbon sequestration and its impact on climate regulation.
3. Describe how watershed protection by forests benefits both the forest ecosystem and human populations.

Employability for the Course:

- Wildlife Biologist/Ornithologist
- Environmental Educator/Interpretive Guide
- Conservation Officer/Environmental Consultant
- Ecotourism Guide
- Research Technician/Field Assistant
- Citizen Science Coordinator

KU1DSCFOR103 INTRODUCTION TO WILDLIFE SCIENCES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
1	DSC	100-199	KU1DSCFOR103	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1		25	50	75	2
			Marks Distribution- Practical			
			10	15	25	

Course Description: This course introduces the fundamental principles of wildlife science, including the study of wildlife ecology, conservation biology, and management practices. It covers the behaviour, population dynamics, and habitat requirements of various wildlife species, as well as the human dimensions of wildlife conservation.

Course Prerequisite: Basic knowledge in biology at 10th level.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Define and explain key concepts in wildlife science, including ecology, behaviour, and conservation.	***R***
2	Describe the ecological roles and habitat requirements of various wildlife species.	***U***
3	Analyze the factors affecting wildlife populations and their dynamics.	***An***
4	Understand and apply the principles of wildlife management and conservation strategies.	***A***

5	Evaluate human impacts on wildlife and develop strategies to mitigate these effects.	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔			✔			
CO 2	✔			✔			
CO 3	✔			✔		✔	
CO 4	✔	✔				✔	✔
CO 5	✔	✔			✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: Fundamentals of Wildlife Science (15 Hours)**	
	1	Wildlife Science
		a) Definitions and values of wildlife
		b) Characteristics of wildlife in different biomes and zoogeographic regions of the world
	2	Behaviour of Wild animals
		a) Instinctive behaviour, learned behaviour, dispersal behaviour, social behaviour, and reproductive behaviour
		b) Clutch size and litter size and age of maturity
		c) Territory, Home range and significance of territory

	3	Adaptations of wild animals
		a) Aestivation, hibernation, torpor and diapause
		b) Predator avoidance – camouflage, mimicry and schooling
2	**MODULE TITLE: Mammalogy and Indian mammals (15 Hours)**	
	1	Characteristics of class mammalia
	2	Classification of mammals and the detailed account on mammalian orders of Indian sub-continent:
		a) Primata, Carnivora, Proboscidea, Artiodactyla
		b) Rodentia, Chiroptera, Lagomorpha
	3	Zoogeography of Indian mammals
3	**MODULE TITLE: Herpetology (10 Hours)**	
	1	Reptiles and Amphibians
	2	Role of temperature in sex determination in reptiles
	3	Identification of venomous and nonvenomous snakes
	4	Snake bites, Venom, Anti-venom, First Aid and Management of snake bite cases.
4	**MODULE TITLE: Conservation Strategies (5 Hours)**	
	1	Conservation Principles
		ex-situ conservation
		d species and Endemic species
	2	Conservation projects in India
		a) Project Tiger
		b) Project Lion

		c) Project Elephant
		d) Project crocodile
	3	Causes of Extinction
5	**Teacher Specific Module (30 Hour)**	
	Prepare based on the current trends in wildlife science. Include human animal interactions and its implications	
	Space to fill the selected area/ activity	

Essential Readings:

1. Dasmann, R.F. 1982. Wildlife Biology. Wiley Pub. New York.
2. Gee EP. 2000. The wildlife of India. Harper Collins Publication.
3. Johnsingh AJT. (Ed.). 2003. The Mammals of South Asia: Ecology, Behaviour and Conservation. Permanent Black.
4. Prater, S.H. 1971. The Book of Indian Animals. Oxford University press, Bombay.
5. Daniel JC. 1980. Book of Indian reptiles. OUP
6. Whitaker R and Ashok Captain. 2004. Snakes of India: The Field Guide. Draco Books, Chennai.
7. Primack, R.B. 1993. Essentials of Conservation Biology. Soiner, MA.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1
	3	2

2	1	3
	2	3
	3	4
3	1	5
	2	5
	3	6
	4	6
4	1	7
	2	7
	3	7

Suggested Readings:

- VivekMenon. 2003. Field Guide to Indian Mammals. Penguin Books, India.
- Whitaker R and Ashok Captain. 2004. Snakes of India: The Field Guide. Draco Books, Chennai.
- Kumar and Asija. Biodiversity – Principles and conservation. UpdeshPurohit, Agrobios, Jodhpur
- Negi, S.S. 1993. Biodiversity and its Conservation in India. India Publishing company, New Delhi

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3

d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. Differentiate between instinctive behaviour and learned behaviour in wild animals with examples.
2. What are the primary ecological roles of apex predators in an ecosystem?
3. Describe the term 'biodiversity' and explain why it is crucial for ecosystem stability.

6 Mark Questions

1. Discuss the symbiotic relationships found in coral reef ecosystems and their significance for marine life.
2. Explain the concept of carrying capacity and its relevance to wildlife management.
3. Describe the principles of in-situ conservation and provide examples of its application.
4. Analyze the impact of urbanization on local wildlife populations and their habitats.
5. Discuss the importance of community involvement in wildlife conservation efforts.
6. Explain how population viability analysis (PVA) is used in wildlife management.

14 Mark Questions

1. Analyze the effects of climate change on migration patterns and reproductive cycles of wildlife.
2. Develop a comprehensive plan to mitigate the impact of climate change on a specific wildlife species.

KU1MDCFOR104 ECOTOURISM

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
1	MDC	100-199	KU1MDCFOR104	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		25	50	75	1.5

Course Description: This course provides an in-depth exploration of ecotourism, focusing on its principles, objectives, and impact. Students will learn about the historical context of tourism, different forms and categories, and the classification and dimensions of tourism. Special emphasis will be placed on the principles of ecotourism, its potential in India, stakeholder roles, environmental and social impacts, and sustainable development practices.

Course Prerequisite:

- Ability to write examinations in English

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Recall the definition and historical evolution of tourism and ecotourism.	***R***
2	Discuss the potential of ecotourism in India and the role of various stakeholders.	***U***
3	Apply zoning and carrying capacity concepts to plan ecotourism in protected areas.	***A***
4	Analyze the environmental and social impacts of ecotourism on local communities and ecosystems.	***An***
5	Design an ecotourism project plan, including marketing and business strategies	***C***
6	Evaluate the effectiveness of ecotourism initiatives in contributing to sustainable development	***E***

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

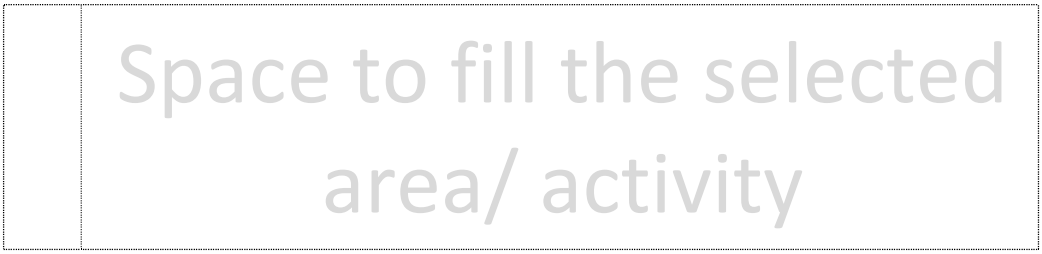
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔						
CO 2		✔		✔			
CO 3							✔
CO 4		✔					✔
CO 5		✔				✔	
CO 6			✔		✔		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: Introduction to Tourism (10 Hours)**	
	1	Tourism-Definition and History
		a) a) Definition of tourism
		b) Historical development of tourism
	2	Forms and Categories of Tourism
		a) Classification of tourism: domestic, international, inbound, and outbound
		b) Different forms: adventure, cultural, sustainable, and ecotourism
	3	Dimensions and Basic Components of Tourism
		a) Key components: attractions, accessibility, amenities, and ancillary services

2	**MODULE TITLE: Fundamentals of Ecotourism (10 Hours)**	
	1	Ecotourism-Definition and Elements
		a) Defining ecotourism
		b) Core elements of ecotourism
	2	Principles and Objectives of Ecotourism
	3	Potential of Ecotourism in India
		a) Key ecotourism sites in India
		b) Forms of Ecotourism: Hard and Soft Ecotourism
3	**MODULE TITLE: Impacts of Ecotourism (10 Hours)**	
	1	Impacts on the Environment
		a) Positive and negative environmental impacts
	2	Social Impacts
		a) Community involvement and cultural impacts
4	**MODULE TITLE: Ecotourism and Sustainable Development (10 Hours)**	
	1	Planning Ecotourism in Protected Areas
		a) Carrying capacity and zoning
		b) Ecotourism in important protected areas of India-
	2	Economic Valuation of Ecotourism Sites
		a) Travel cost method
	3	World Ecotourism Summit
5	**Teacher Specific Module (5 Hours)**	
	Directions: Prepare a visitor satisfaction survey for different ecotourism sites in Kannur	



Essential Readings:

1. Chiranjeev, A. 2008.Concept of tourism.JnanadaPrakashan.
2. Hosetti, B.B. 2007.Ecotourism development and management, Pointer publishers, Jaipur
3. Chiranjeev, A. 2008.Ecotourism planning and Development.JnanadaPrakashan.
4. Aaradhana, S. 2009. Indian tourism, Wildlife tourism and Ecotourism.JnanadaPrakashan. 288 p
5. Honey, M. 2008. Ecotourism and Sustainable development.Island Press.
6. Chiranjeev, A. 2008. Ecological, Social and Cultural aspects of Ecotourism.JnanadaPrakashan.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1
	3	2
2	1	3
	2	3
	3	3
3	1	4
	2	4
	3	4
	4	4
4	1	5
	2	5
	3	6
	4	6

Suggested Readings:

1. Thampi, Santosh P. Ecotourism in Kerala, India: Lessons from the eco-development project in Periyar Tiger Reserve. Vol. 13. ECOCLUB, 2005.
2. Pujar, Sachin C., and Niharranjan Mishra. "Ecotourism industry in India: a review of current practices and prospects." Anatolia 32.2 (2021): 289-302.
3. Singh, Gurinder, Vikas Garg, and Shalini Srivastav. "Ecotourism in India: social trends and pathways on sustainable tourism and eco-travelling." International Journal of Business and Globalisation 28.4 (2021): 468-480.
4. Das, Suchismita. "Ecotourism, sustainable development and the Indian state." Economic and Political Weekly 46.37 (2011): 60-67.
5. Das, Madhumita, and Bani Chatterjee. "Ecotourism: A panacea or a predicament?." Tourism management perspectives 14 (2015): 3-16.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Sample questions to Test Outcome

2 Mark Questions

1. Define tourism and explain its primary components.
2. Trace the historical development of tourism from ancient times to the modern era.
3. What is ecotourism, and how does it differ from traditional forms of tourism?
4. Discuss the historical milestones in the development of ecotourism.

6 Mark Questions

1. Identify and describe key ecotourism sites in India.

2. Discuss the different forms of ecotourism practiced in India, highlighting examples of hard and soft ecotourism.
3. Analyze the roles of government agencies, NGOs, and local communities in promoting ecotourism in India.
4. What are the objectives of ecotourism, and how do they align with sustainable development goals in India?
5. Explain the impact of ecotourism on local economies and biodiversity conservation in India.

14 Mark Questions

1. Discuss the concept of zoning in ecotourism planning and provide examples of its application in protected areas.
2. Analyze the challenges and benefits of implementing carrying capacity limits in popular ecotourism destinations.
3. Develop a zoning plan for an ecotourism site, considering environmental, social, and economic factors.

KU2DSCFOR105 PRINCIPLES AND PRACTICE OF SILVICULTURE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	DSC	100-199	KU2DSCFOR105	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1		25	50	75	2
			Marks Distribution- Practical			
			10	15	25	

Course Description: The course "Principles and Practices of Silviculture" provides a comprehensive understanding of forestry principles, focusing on ecological processes, sustainable resource management, and biodiversity conservation. Students explore fundamental concepts such as the definitions of forests, forestry, and silviculture, alongside the objectives and scope of silviculture and its interrelation with other branches of forestry. Through the application of knowledge on silvicultural systems, students analyze forest management practices, assess site suitability for regeneration based on principles of tree growth and development, and engage in field techniques such as forest inventory and monitoring. Emphasizing sustainable forestry practices, the course fosters environmental stewardship and equips students to contribute to the advancement of forestry knowledge and practices, addressing global challenges including climate change.

Course Prerequisite:

Basic knowledge in Biology at 10th level, Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Recall fundamental concepts of silviculture, including definitions of forests, forestry, and silviculture.	***R***

2	Explain the objectives and scope of silviculture and its relationship with other branches of forestry.	***U***
3	Apply knowledge of silvicultural systems to classify and analyze forest management practices.	***A***
4	Utilize principles of tree growth and development to assess site suitability for regeneration.	***A***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔						
CO 2	✔				✔		
CO 3		✔	✔			✔	
CO 4		✔		✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: INTRODUCTION TO SILVICULTURE (10 Hours)**	
	1	Silviculture
		a) Objectives
		b) Scope

	2	Relation with Other Branches of Forestry
	3	Silvics and Site Factors
		a) Climatic Factors
		b) Edaphic Factors
		c) Physiographic Factors
		d) Biotic Factors
		e) Interactions among Site Factors
	4	TREE GROWTH AND DEVELOPMENT
		a) Trees and Their Distinguishing Features
		b) Growth and Development of Trees

2	**MODULE TITLE: SILVICULTURAL SYSTEMS (15 Hours)**	
	1	Definition, Scope, and Classification of Silvicultural Systems
	2	Systems of Concentrated Regeneration
		a) Clear Felling Systems
		b) Shelterwood System
	3	Systems of Diffused Regeneration
		a) Selection System and Its Modifications
	4	Accessory Systems
		a) Coppice Systems
		b) Culm Selection System in Bamboo

		c) Canopy Lifting System in Andaman

3	**MODULE TITLE: REGENERATION OF FORESTS (15 Hours)**	
	1	Objectives and Ecology of Regeneration
	2	Natural Regeneration Processes
		a) Seed Production
		b) Seed Dispersal
		c) Germination and Establishment
		d) Requirements for Natural Regeneration
		e) Advance Growth
		f) Coppice and Root Sucker Regeneration
		g) Regeneration Survey
		h) Natural Regeneration Supplemented by Artificial Regeneration
	3	Artificial Regeneration
		a) Objectives and Advantages of Artificial Regeneration
		b) Factors Governing the Choice of Regeneration Techniques

4	**MODULE TITLE: TREE PLANTING AND CULTURAL OPERATIONS (5 Hours)**	
	1	Tree Planting Techniques
		a) Sowing vs. Planting
		b) Different Kinds of Pits
	2	Tending and Cultural Operations

		a) Weeding (Kinds of Weeding)
		b) Release Operations
		c) Singling and Cleaning
		d) Liberation Cutting

5	**Teacher Specific Module (30 Hours)**
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.
	5.1 Visit a local forest or plantation to observe different silvicultural practices. 5.2 Set up a small weather station to collect data on temperature, precipitation, humidity, and wind speed over a period of time. 5.3 Identify and classify different silvicultural systems (clear felling, shelterwood, selection) in a local forest or through case studies. 5.4 Visit a site where clear felling is practiced. Study the regeneration process and document the species regenerating naturally. 5.5 Compare sites with natural regeneration and those with artificial regeneration techniques (e.g., planting, seeding). Evaluate the success and challenges of each method. Space to fill the selected area/ activity

Essential Readings:

1. Günter, S., 2011. Introduction to silviculture in the tropics. In *Silviculture in the tropics* (pp. 3-10). Berlin, Heidelberg: Springer Berlin Heidelberg.
2. Khanna, L.S.1989. Principles and Practice of Silviculture. Khanna Bandhu, 7 Tilak Marg, Dehra Dun
3. Kozlowski, T.T., 1971. Growth and development of trees. Volume I: Seed germination, ontogeny and shoot growth. *Growth and development of trees. Volume I: Seed germination, ontogeny and shoot growth.*

4. Matthews, J.D., 1991. *Silvicultural systems*. Oxford University Press.
5. Duryea, M.L. and Dougherty, P.M., 1991. *Forest regeneration manual* (Vol. 36). Springer Science & Business Media.
6. Toumey, J.W. and Korstian, C.F., 1942. Seeding and planting in the practice of forestry. *Seeding and planting in the practice of forestry.*, (3rd ed.).
7. Evans, Julian, and John W Turnbull, 'Plantation maintenance', Plantation Forestry in the Tropics: The Role, Silviculture, and Use of Planted Forests for Industrial, Social, Environmental, and Agroforestry Purposes (Oxford, 2004; online edn, Oxford Academic, 31 Oct. 2023),

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	2
	4	3
2	1	4
	2	4
	3	4
	4	4
	5	4
3	1	5
	2	5
	3	5
4	1	6
	2	7
	3	7

Suggested Readings:

- Nyland, R. D. (2016). Silviculture: Concepts and Applications, Third Edition. Waveland Press, 680 pages
- Ram Parkash (1991). Theory and Practice of Silvicultural Systems International Books & Periodicals, Dehra Dun, 298 pages
- Smith, D.M. (1986). Practice of Silviculture, Edn 8. New York, John Wiley.

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. Define silviculture and explain how it differs from general forestry.
2. Give general and ecological definitions of forest
3. Explain the term 'forestry' and describe its main components.
4. Discuss the primary objectives of silviculture.
5. How does silviculture contribute to sustainable forest management?

6 Mark Questions

1. Describe the scope of silviculture in modern forestry practices.
2. Explain the relationship between silviculture and forest ecology.
3. How does silviculture integrate with forest economics and policy?
4. Discuss the role of silviculture in forest conservation and biodiversity management.

14 Mark Questions

1. Define silvicultural systems and explain their importance in forest management.
2. Compare and contrast the clear felling system and the shelterwood system.
3. Explain the selection system of diffused regeneration and its advantages.
4. What are the key characteristics of the coppice system, and where is it commonly used?
5. Analyze the culm selection system in bamboo and discuss its benefits for sustainable management.

Employability for the Course:

- Forest managers
- Silviculturists
- Ecological restoration specialists
- Forest ecologists
- Wildlife biologists
- Environmental planners.

KU2DSCFOR106 FOREST BOTANY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	DSC	100-199	KU2DSCFOR106	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1		25	50	75	2
			Marks Distribution- Practical			
			10	15	25	

Course Description: This course offers a comprehensive study of plant taxonomy, focusing on the classification, identification, and nomenclature of plants. Students will learn about the morphological characteristics, evolutionary relationships, and ecological significance of plants. Fieldwork and laboratory sessions will provide hands-on experience in identifying and classifying plants.

Course Prerequisite:

- Basic understanding of botany or plant science

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Recall and define basic concepts and terminology related to plant taxonomy, such as taxonomic hierarchy, species, and botanical nomenclature.	***R***
2	Demonstrate understanding by explaining the principles of plant classification and the significance of morphological characteristics in identifying plant species.	***U***
3	Apply their knowledge to identify plant species using taxonomic keys and field guides during field trips and laboratory exercises.	***A***
4	Create herbarium specimens and comprehensive documentation for plant species they have identified, integrating morphological	***C***

	data.	

******Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔						
CO 2	✔			✔			
CO 3			✔	✔			
CO 4				✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: INTRODUCTION TO PLANT BIOLOGY (10 Hours)**	
	1	External plant morphology- Vegetative characters
		a) Root types and functions
		b) Stems – functions and branching pattern
		c) Leaves – Parts, Form and Phyllotaxy
	2	External plant morphology- Reproductive characters
		a) Flowers - Unisexual and bisexual, symmetry
		b) Fruits – Simple, Aggregate and Multiple
		c) Seeds – Monocot and dicot
	3	Classification of Plant Life Forms

		a) Herbs
		b) Shrubs
		c) Trees
		d) Other forms
2	**MODULE TITLE: INTRODUCTION TO PLANT TAXONOMY (15 Hours)**	
	1	Definition and significance of taxonomy
	2	History and development of plant taxonomy
	3	Principles of classification
	4	Nomenclature and binomial system
3	**MODULE TITLE: PLANT IDENTIFICATION TECHNIQUES (15 Hours)**	
	1	Morphological characteristics of plants
	2	Reproductive characteristics of plants
		a) Salient features and Parts of the Flower- Bract, Calyx, Corolla, Androecium, Gynoecium
		b) Floral arrangement- types
		c) Relative position, cohesion, adhesion, Symmetry of flower
		d) Aestivation
		e) Placentation- types
		f) Inflorescence: Racemose, Cymose, Special type and Mixed types
	3	Use of dichotomous keys
	4	Herbarium techniques
	5	Modern tools in plant identification

4	**MODULE TITLE: ECONOMIC BOTANY (5 Hours)**	
	1	Economic importance of common trees
		a) Timber
		b) NTFP
	2	Phytogeography
		a) Factors affecting plant distribution
		b) Phytogeographic zones of India
5	**Teacher Specific Module (30 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives, and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	5.1 Conduct a Field trip to collect plant specimens 5.2 Use of dichotomous keys for plant identification 5.3 Techniques for pressing, drying, and mounting plant specimens 5.4 Labelling and cataloguing herbarium sheets 5.6 Preparation of Plant identification charts 5.7 Collection and Identification of Non-Timber Forest Products in Kerala Space to fill the selected area/ activity	

Essential Readings:

1. Kaplan, D.R., 2001. The science of plant morphology: definition, history, and role in modern biology. *American journal of botany*, *88*(10), pp.1711-1741.
2. Waller, D.M., 1988. Plant morphology and reproduction. *Plant reproductive ecology: patterns and strategies*, pp.203-227.
3. Lawrence, G.H., 1955. *An introduction to plant taxonomy*. Central Book Depot.
4. Backlund, A. and Bremer, K., 1998. To be or not to be. Principles of classification and monotypic plant families. *Taxon*, *47*(2), pp.391-400.
5. Roseline, A., 2019. *Botanical nomenclature*. MJP Publisher.
6. Foster, A.S. and Gifford, E.M., 1959. Comparative morphology of vascular plants. *Comparative morphology of vascular plants.*

7. Waller, D.M., 1988. Plant morphology and reproduction. *Plant reproductive ecology: patterns and strategies*, pp.203-227.
8. Fisher, P.L., Houseal, A.K., Tuthill, D. and Shim, J., 2016. Lesson 6: Plant Identification and Dichotomous Keys.
9. Paul, P., Dhar, S., Chowdhury, M. and Das, D., 2020. *Herbarium technique: evolution from conventional to digitization*. Orange Books Publication.
10. Finger, A., Groß, J. and Zabel, J., 2022. Plant Identification in the 21st Century—What Possibilities Do Modern Identification Keys Offer for Biology Lessons. *Education Sciences*, *12*(12), p.849.
11. Seth, M.K., 2003. Trees and their economic importance. *The Botanical Review*, *69*(4), pp.321-376.
12. Croizat, L., 2013. *Manual of phytogeography: an account of plant-dispersal throughout the world*. Springer.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3
2	1	3
	2	3
	3	4
	4	5
3	1	6
	2	7
	3	8
	4	9
	5	10
4	1	11
	2	12

Suggested Readings:

- Sambamurthy, A. V. S. S. 2005. Taxonomy of Angiosperms. I.K International Pvt. Ltd. 892 p.
- Jeffrey, C. 1982. An Introduction to plant taxonomy. Allied publishers. 154p.
- Henry, A. N. and Chandrabose, M. 1980. An Aid to the International Code of Botanical Nomenclature. Today and Tomorrow printers and publishers. 100p.
- Johri, R. M and SnehLata. 2005. Taxonomy- 1 (Systematics and Morphology). Sonali Publications. 340 p
- Johri, R. M and SnehLata. 2005. Taxonomy- 2 (Polypetalae). Sonali Publications. 300 p
- Johri, R. M and SnehLata. 2005. Taxonomy- 3 (Gamopetalae). Sonali Publications. 190 p

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4

b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. Define plant taxonomy and explain its significance in the study of botany.
2. What is the taxonomic hierarchy, and how is it used to classify plants?
3. Explain the concept of species in botanical nomenclature.
4. Describe the binomial system of nomenclature and its importance in plant taxonomy.
5. What are the major taxonomic ranks in the hierarchical classification of plants?

6 Mark Questions

1. Discuss the history and development of plant taxonomy, highlighting key milestones.
2. Explain the principles of plant classification and their application in modern botany.
3. Describe the various types of root systems and their functions in plants.
4. What are the different branching patterns of stems, and how do they contribute to plant identification?
5. Explain the parts of a leaf and the different forms and phyllotaxy observed in plants.
6. Differentiate between unisexual and bisexual flowers, and explain the significance of floral symmetry.

14 Mark Questions

1. Explain the different types of placentation observed in plants.
2. Describe the various types of inflorescence (racemose, cymose, special, and mixed) and their significance in taxonomy.

Employability for the Course:

- Botanist
- Taxonomist
- Environmental Consultant

KU2DSCFOR107 FIELD ORNITHOLOGY AND BIRD WATCHING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	DSC	100-199	KU2DSCFOR107	4	75

<table>
<tr><td colspan="3">Learning Approach (Hours/ Week)</td><td colspan="3">Marks Distribution- Theory</td><td rowspan="2">Duration of ESE (Hours)</td></tr>
<tr><td>Lecture</td><td>Practical/ Internship</td><td>Tutorial</td><td>CE</td><td>ESE</td><td>Total</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">1</td><td rowspan="3"></td><td>25</td><td>50</td><td>75</td><td rowspan="3">2</td></tr>
<tr><td colspan="3">Marks Distribution- Practical</td></tr>
<tr><td>10</td><td>15</td><td>25</td></tr>
</table>

Course Description: This course delves into the captivating world of avian species, offering insights into their biology, behaviours, and habitats. Through a blend of theoretical knowledge and practical field experiences, students will develop skills in bird identification, observation, and conservation, fostering a deep appreciation for the diverse avifauna around them.

Course Prerequisite:

- Basic knowledge in Biology

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Identify various bird species using visual and auditory cues.	***R***
2	Explain the anatomical features and physiological functions of birds.	***U***
3	Analyze bird behaviors and their ecological significance.	***A***
4	Differentiate between similar bird species by analyzing key physical and behavioral characteristics.	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create ©***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1				✔			
CO 2	✔						
CO 3	✔		✔				
CO 4				✔			
CO 5						✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: INTRODUCTION TO ORNITHOLOGY (10 Hours)**	
	1	Ornithology
		a) Definition and scope
		b) Renowned ornithologists and their contribution.
	2	Characteristics of birds
	3	Importance of birds in ecosystems
2	**MODULE TITLE: BIRD IDENTIFICATION TECHNIQUES (15 Hours)**	
	1	Bird identification features
		a) Visual Identification
		b) Auditory identification

	2	Techniques for bird watching
		1. Principles of Bird Watching
		2. Bird Watching Equipment and Tools
		3. Techniques for Effective Bird Watching
3	**MODULE TITLE: HABITATS AND BEHAVIOR (15 Hours)**	
	1	Bird Habitats
		a) Types of Habitats
		b) Habitat Preferences
	2	Bird Activities
		a) Movement
		b) Feeding
		c) Nesting and Breeding
		d) Flocking and roosting
	3	Migration in Birds
		a) Types
		b) Causes
		c) Significance
4	**MODULE TITLE: FIELD TECHNIQUES IN ORNITHOLOGY (5 Hours)**	
	1	Field Study Methods
		a) Banding and Tagging
	2	Data Collection

	3	Citizen Science and Community Involvement
	Teacher Specific Module (30 Hours)	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
5	5.1 Overview of binoculars, spotting scopes, and cameras. 5.2 Practice using field guides and bird identification apps. 5.3 Introduction to field notebooks and data recording techniques. 5.4 Guided bird watching session in a local area 5.5 Focus on identifying common local species. 5.6 Practice using field guides to confirm identifications. 5.7 Audio session for learning bird calls and songs. 5.8 Field trip to a diverse range of habitats (forests, wetlands, grasslands). 5.9 Habitat mapping and description exercises. 5.10 Recording species observed in different habitats. 5.11 Participation in a citizen science project such as eBird, the Christmas Bird Count, or a local bird survey. Space to fill the selected area/ activity	

Essential Readings:

1. Morrison, M.L., Rodewald, A.D., Voelker, G., Colón, M.R. and Prather, J.F. eds., 2018. *Ornithology: foundation, analysis, and application*. JHU Press.
2. Mainwaring, M.C., 2017. Why birds matter: avian ecological function and ecosystem services. *The Condor: Ornithological Applications*, *119*(2), pp.354-355.
3. Dunne, P., 2012. *The Art of Bird Identification: A Straightforward Approach to Putting a Name to the Bird*. Stackpole Books.
4. Dunne, P., 2003. *Pete Dunne on bird watching: The how-to, where-to, and when-to of birding*. Houghton Mifflin Harcourt.
5. Fuller, R.J. ed., 2012. *Birds and habitat: relationships in changing landscapes*. Cambridge University Press.
6. Wallace GJ and HD Mahan. 20015. An introduction to ornithology. Mc Million Publishing Company, New York.

7. Collias, N.E. and Collias, E.C., 2014. *Nest building and bird behavior* (Vol. 857). Princeton University Press.
8. Newton, I., 2023. *The migration ecology of birds*. Elsevier.
9. Ali, S., 1979. Bird study in India: its history and its importance. *India International Centre Quarterly*, *6*(2), pp.127-139.
10. Shyamal, L., 2007. Opinion: Taking indian ornithology into the information age. *Indian Birds*, *3*(4), pp.122-137.
11. Chandler, M., See, L., Copas, K., Bonde, A.M., López, B.C., Danielsen, F., Legind, J.K., Masinde, S., Miller-Rushing, A.J., Newman, G. and Rosemartin, A., 2017. Contribution of citizen science towards international biodiversity monitoring. *Biological conservation*, *213*, pp.280-294.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1
	3	2
2	1	3
	2	4
3	1	5
	2	6,7
	3	8
4	1	9
	2	10
	3	11

Suggested Readings:

1. Neelakantan,K.K.1984. "KeralathilePakshikal". Kerala Sahithya Academy, Thrissur. 584pp.
2. Grimmet, R. Inskipp T and Inskipp, I. 2000. Pocket Guide to the of Birds of Indian subcontinent.Christopher Helm series
3. Grimmet, R. Inskipp, T and Nameer, P.O. 2007. Birds of southern India, BNHS series.
4. Sashikumar C., Praveen J., Palot M. J. and Nameer P. O. 2012. Birds of Kerala – status and distribution. DC Books.

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. Briefly explain the significance of Archaeopteryx in the evolution of birds.
2. Name two renowned ornithologists and describe one significant contribution from each.
3. List three key visual features used to identify birds.
4. What are the primary reasons birds migrate?

6 Mark Questions

1. Why are birds considered important indicators of environmental health?
2. How can bird calls and songs be used to identify species?
3. Describe three different types of habitats where birds are commonly found.

14 Mark Questions

1. What are the essential tools for bird watching, and why are they important?
2. Explain the significance of foraging behavior in birds.
3. What are the common methods used for conducting bird surveys?

Employability for the Course:

- Wildlife Biologist/Ornithologist
- Environmental Educator/Interpretive Guide
- Conservation Officer/Environmental Consultant
- Ecotourism Guide
- Research Technician/Field Assistant
- Citizen Science Coordinator

KU2MDCFOR108 WILDLIFE PHOTOGRAPHY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	MDC	100-199	KU1MDCFOR108	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		25	50	75	1.5

Course Description: Wildlife Photography is a Skill Enhancement course aims in photography of wildlife and nature, and story-telling using visual tools. Through a blend of theoretical lectures, hands-on practical sessions, and immersive field trips, students learn the fundamentals of wildlife photography, mastering essential techniques such as composition, camera settings, and understanding animal behaviour. They explore the intricacies of capturing dynamic shots of birds, mammals, and macro subjects, guided by ethical principles and a deep appreciation for wildlife conservation.

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Define and explain the principles of wildlife and nature photography, including camera settings, composition techniques, and ethical considerations.	***U***
2	Develop the knowledge and skills to capture well-exposed and composed photographs of wildlife and natural landscapes in various environmental conditions.	***A***

3	Analyze photographs to interpret wildlife behavior, habitat characteristics, and environmental relationships, identifying patterns and connections within the natural world.	***An***
4	Generate visually compelling narratives through photography that communicate stories, emotions, and concepts	***C***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔			✔			
CO 2			✔	✔			
CO 3	✔			✔		✔	
CO 4					✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: BASIC ELEMENTS OF WILDLIFE PHOTOGRAPHY (10 Hours)**	
	1	Photography and overview of wildlife photography as a genre
	2	Essential gear and equipment for wildlife photography
	3	Workings of different kinds of cameras and lenses
	4	Use of light and speed for different kinds of photographs
		a) Motion photography

		b) Camera settings and exposure for wildlife Photography
2	**MODULE TITLE: COMPOSING AN IMAGE (10 Hours)**	
	1	Basic rules for composing good wildlife and nature photography
	2	Ethical considerations in wildlife photography
	3	Using photography as an effective tool for conservation story telling
		a) Storytelling and Portfolio Development
	4	Photography in research and conservation
3	**MODULE TITLE: POST-PROCESSING AND IMAGE EDITING (10 Hours)**	
	1	Introduction to post-processing software for wildlife photography
	2	Adjustments for exposure: techniques for fine-tuning exposure and brightness
	3	Color: understanding color correction and white balance adjustments
		a) Enhancing Contrast
		b) Sharpening techniques
	4	Preserving authenticity and ethical considerations in post-processing.
4	**MODULE TITLE: ADVANCED FIELD TECHNIQUES AND SKILLS (10 Hours)**	
	1	Mastering manual settings for challenging conditions
		a) Techniques for capturing fast-moving subjects
		b) Low-light photography
	2	Using remote cameras and drones for unique perspectives
	3	Developing a narrative through a series of images
	4	Selecting and curating images for a cohesive wildlife photography portfolio

5	**Teacher Specific Module (5 Hours)**
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.
	Space to fill the selected area/ activity

Essential Readings:

1. John and Barbara Gerlach. 2012. Digital Wildlife Photography. Routledge.
2. Excell, L. S. (2011). Wildlife Photography: From snapshots to great shots. Peachpit Press.
3. Parmenter, T. (1982). Wildlife and Nature Photography, by Michael Freeman. Croom Helm. London,£ 13.95. Oryx, 16(4).
4. Young, S. (2022). Wildlife Photography Fieldcraft. Pelagic Publishing Ltd.
5. Caruso, R. D., & Postel, G. C. (2002). Image editing with Adobe Photoshop 6.0. Radiographics, 22(4).
6. Mangelson, T. D. (2013). Images of Nature: The Photographs of Thomas D. Mangelson. Rizzoli International Publications.
7. Frost, J. (2018). Creating a Wildlife Photography Portfolio. Ammonite Press.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1
	3	2
	4	2
2	1	3

	2	3
	3	4
	4	4
3	1	5
	2	5
	3	5
	4	5
4	1	6
	2	6
	3	7
	4	7

Suggested Readings:

- Prakel, D. (2007). Basics Photography 02: Lighting (Vol. 2). AVA Publishing.
- Smith, J. (2020). The Positive and Negative Effects of Photography on Wildlife.
- Banek, C., & Banek, G. (2013). Learning to Photograph-Volume 1: Camera, Equipment, and Basic Photographic Techniques. Rocky Nook, Inc.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Sample questions to Test Outcome

2 Mark Questions

1. How would you adjust your camera settings for photographing wildlife in a dense forest with low light?
2. What is an ethical consideration to keep in mind during post-processing?
3. Name two popular post-processing software programs and describe one key feature of each.

6 Mark Questions

1. What criteria should you consider when selecting images for a wildlife photography portfolio?
2. How can you develop a strong narrative through a series of wildlife photographs?
3. What are some techniques for successful low-light wildlife photography?
4. What is the best approach for tracking and capturing sharp images of fast-moving wildlife?
5. What is the purpose of sharpening in wildlife photography, and how should it be applied?

14 Mark Questions

1. Describe a scenario where using a drone could enhance wildlife photography.
2. Describe a technique for enhancing contrast in a wildlife photo without losing detail.
3. How can wildlife photography contribute to conservation efforts?

KU3DSCFOR201 TREE PHYSIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCFOR201	3 + 1	75

<table>
<tr><td colspan="3">Learning Approach (Hours/ Week)</td><td colspan="3">Marks Distribution- Theory</td><td rowspan="2">Duration of ESE (Hours)</td></tr>
<tr><td>Lecture</td><td>Practical/ Internship</td><td>Tutorial</td><td>CE</td><td>ESE</td><td>Total</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">1</td><td rowspan="4"></td><td>25</td><td>50</td><td>75</td><td rowspan="4">1.5</td></tr>
<tr><td colspan="3">Marks Distribution- Practical</td></tr>
<tr><td>10</td><td>15</td><td>25</td></tr>
</table>

Course Description: This course provides a comprehensive understanding of the physiological processes that govern tree growth, development, and adaptation. Topics include water and nutrient transport, photosynthesis, respiration, hormonal regulation, and environmental stress responses in trees. Emphasis will be placed on integrating structure-function relationships and understanding how trees interact with their environment over long lifespans.

Course Prerequisite:

Basic knowledge in Forest Ecology

Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Explain the fundamental physiological processes in trees.	***U***
2	Analyze how trees manage water, nutrients, and energy.	***An***

3	Apply knowledge of tree physiology to assess growth and productivity under varying environments.	***A***
4	Evaluate stress responses and adaptive strategies of trees.	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔		✔		✔
CO 2	✔	✔		✔		✔	✔
CO 3	✔	✔	✔		✔	✔	✔
CO 4	✔	✔	✔				✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: FUNDAMENTALS OF TREE PHYSIOLOGY (15 HOURS)**	
	1	Scope, importance and applications of tree physiology
	2	Water relations
		a) Absorption
		b) Transport

		c) Transpiration
		d) Water potential
	3	Mineral nutrition
		d) Uptake
		e) Transport
		f) Deficiency symptoms
2	**MODULE TITLE: PHOTOSYNTHESIS AND RESPIRATION (15 HOURS)**	
	1	Photosynthesis
		a) Light and dark reactions
		b) Factors affecting photosynthesis
	2	Translocation of assimilates
	3	Respiration
		a) Glycolysis
		b) TCA cycle
		c) Electron Transport Chain
3	**MODULE TITLE: HORMONAL REGULATION AND GROWTH (10 HOURS)**	
	1	Plant growth regulators
		a) Auxins
		b) Gibberellins
		c) Cytokinins
		d) ABA
		e) Ethylene

4	**MODULE TITLE: STRESS PHYSIOLOGY AND ADAPTATION (15 HOURS)**	
	1	Drought, salinity, and temperature stress
	2	Physiological adaptations in different forest types
	3	Tree responses to climate change
5	**Teacher Specific Module (20 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	Space to fill the selected area/ activity	

Essential Readings:

13. Kramer, P.J., 1986. The role of physiology in forestry. *Tree physiology*, *2*(1-2-3), pp.1-16.
14. Kramer PJ and Kozlowshi TT. 1979. Physiology of Woody Plants. Academic Press.
15. Kramer PJ and Boyer JS 1995. *Water Relations of Plants and Soils*. San Diego, CA: Academic Press.
16. Kathpalia, R., Bhatla, S.C. (2018). Plant Mineral Nutrition. In: Plant Physiology, Development and Metabolism. Springer, Singapore. https://doi.org/10.1007/978-981-13-2023-1_2
17. Taiz, L. and Zeiger, E. 2007. Plant Physiology 4th Ed. Sinauer Associates Inc. Publishers, Sunderland.
18. Kozlowski TT. 1971. Growth and Development of Trees. Vol. I. Academic Press.
19. Larcher W. 1980. Physiological Plant Ecology. Springer-Verlag.
20. Raghavendra AS. 1991. Physiology of Trees. John Wiley & Sons.
21. Kumar, S., Sachdeva, S., Bhat, K.V. and Vats, S., 2018. Plant responses to drought stress: physiological, biochemical and molecular basis. *Biotic and abiotic stress tolerance in plants*, pp.1-25.
22. Raza, A., Ashraf, F., Zou, X., Zhang, X. and Tosif, H., 2020. Plant adaptation and tolerance to environmental stresses: mechanisms and perspectives. *Plant ecophysiology and adaptation under climate change: Mechanisms and perspectives I: General consequences and plant responses*, pp.117-145.

23. Mattheck, C., 1995. Wood—the internal optimization of trees. *Arboricultural Journal*, *19*(2), pp.97-110.
24. Archer, R.R., 2013. *Growth stresses and strains in trees* (Vol. 3). Springer Science & Business Media.
25. Mohren, G.M.J., Kramer, K. and Sabaté, S. eds., 1997. *Impacts of global change on tree physiology and forest ecosystems* (Vol. 52). Springer Science & Business Media.
26. Brubaker, L.B., 1986. Responses of tree populations to climatic change. *Vegetatio*, *67*, pp.119-130.
27. Leites, L. and Benito Garzón, M., 2023. Forest tree species adaptation to climate across biomes: Building on the legacy of ecological genetics to anticipate responses to climate change. *Global Change Biology*, *29*(17), pp.4711-4730.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3,4
2	1	5
	2	6,6
	3	5,6,7
3	1	7,8
4	1	9
	2	10,11,12
	3	13,14,15

Suggested Readings:

1. Goldstein, G. and Santiago, L.S., 2016. *Tropical tree physiology*. Springer Berlin Heidelberg.
2. Pallardy, S.G., 2010. *Physiology of woody plants*. academic press.
3. Kramer, P., 2012. *Physiology of woody plants*. Elsevier.
4. Landsberg, J. and Sands, P., 2011. *Physiological ecology of forest production: principles, processes and models* (Vol. 4). Amsterdam.
5. Raghavendra, A.S. ed., 1991. *Physiology of trees* (pp. x+-509).

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2

Total	**25**

Sample questions to Test Outcome

2 Mark Questions

1. Define *water potential* and list its components.
2. Name two deficiency symptoms of nitrogen in trees.
3. Write the net equation of photosynthesis.
4. What role does RuBisCO play in the Calvin cycle?
5. Name two functions of auxins in tree growth.
6. How does ethylene influence leaf abscission?
7. List two physiological changes in trees under temperature stress.

6 Mark Questions

1. Compare the pathways of *apoplastic* and *symplastic water transport* in roots.
2. Analyze how *transpiration* affects mineral uptake in trees.
3. Using a graph, explain how light intensity affects the rate of photosynthesis in shade-tolerant vs. shade-intolerant trees.
4. Design an experiment to compare respiratory rates in tropical vs. temperate tree species. Justify your methodology and predict outcomes.
5. Analyze how gibberellins and ABA antagonistically regulate seed dormancy.
6. Contrast the osmotic adjustment strategies of mangroves and alpine trees.

14 Mark Questions

1. *"Drought stress alters tree physiology more profoundly than salinity stress."* Critically evaluate this statement with examples of adaptive mechanisms.
2. "Climate change will disproportionately impact boreal forests." Evaluate this claim by integrating physiological, hormonal, and photosynthetic adaptations.

Employability for the Course:

- *Forest Ecologist*
- *Silviculturist*
- *Conservation Scientist*

KU3DSCFOR202 WOOD STRUCTURE AND FUNCTIONS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCFOR202	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	0	0	30	70	100	2

Course Description: This course explores the anatomical, physical, and chemical properties of wood, emphasizing its biological formation, structural diversity, and functional roles in trees and human applications. Topics include wood cell types, growth rings, density variations, mechanical properties, and industrial uses. The course integrates laboratory techniques for wood identification and analysis.

Course Prerequisite:

Basic knowledge of Plant Anatomy & Physiology

Ability to write examinations in English

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Describe the cellular and chemical composition of wood.	***U***
2	Analyze the relationship between wood structure and its mechanical properties.	***An***
3	Apply wood identification techniques using microscopic and macroscopic features.	***A***
4	Evaluate the suitability of wood for different industrial and ecological applications.	***E***

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	✔	✔					✔
CO2	✔	✔		✔			
CO3	✔	✔	✔				
CO4	✔	✔	✔	✔	✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE 1: FUNDAMENTALS OF WOOD ANATOMY (15 HOURS)**	
	1	Introduction to Wood Science
		Scope, importance, and applications in forestry/industry.
	2	Cellular Structure of Wood
		a) Tracheids, fibers, vessels, parenchyma
		b) Softwood vs. hardwood anatomy
	3	Wood Formation (Cambial Activity)
		a) Growth rings
		b) Earlywood vs. latewood
2	**MODULE 2: PHYSICAL & CHEMICAL PROPERTIES (15 HOURS)**	

	1	Wood Density and Moisture Relations
		a) Specific gravity
		b) Shrinkage and swelling
	2	Chemical Composition
	3	Mechanical Properties
3	**MODULE 3: WOOD IDENTIFICATION & CLASSIFICATION (15 HOURS)**	
	1	Macroscopic Features
		a) Grain
		b) Texture
		c) Figure
		d) Color
	2	Microscopic Techniques
4	**MODULE 4: FUNCTIONAL APPLICATIONS (15 HOURS)**	
	1	Ecological Roles of Wood
	2	Industrial Uses
5	**Teacher Specific Module (15 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	Space to fill the selected area/ activity	

Essential Readings:

1. Panshin, A. J., & de Zeeuw, C. (1980). *Textbook of Wood Technology* (4th ed.). McGraw-Hill.
2. Schweingruber, F. H. (2007). *Wood Structure and Environment*. Springer.

3. Carlquist, S. (2001). Comparative Wood Anatomy. Springer.
4. Walker, J. C. F. (2006). Primary Wood Processing (2nd ed.). Springer.
5. Larson, P. R. (1994). The Vascular Cambium: Development and Structure. Springer.
6. Bowyer, J. L., et al. (2007). Forest Products and Wood Science (6th ed.). Wiley-Blackwell.
7. Fengel, D., & Wegener, G. (1989). Wood: Chemistry, Ultrastructure, Reactions. De Gruyter.
8. Hoadley, R. B. (1990). *Identifying Wood: Accurate Results with Simple Tools*. Taunton Press.
9. Dinwoodie, J. M. (2000). Timber: Its Nature and Behaviour (2nd ed.). Taylor & Francis.
10. Rowell, R. M. (2012). Handbook of Wood Chemistry and Wood Composites. CRC Press.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1,2
	3	2,3
2	1	4,5
	2	6,7
	3	7
3	1	8
	2	8
4	1	9,10
	2	9,10

Suggested Readings:

1. Carlquist, S., 2013. *Comparative wood anatomy: systematic, ecological, and evolutionary aspects of dicotyledon wood*. Springer Science & Business Media.
2. Krabel, D., 2016. Fundamentals of tree biology. *Urban Tree Management: For the Sustainable Development of Green Cities*, p.20.
3. Wiedenhoeft, A. and Eberhardt, T., 2021. Structure and function of wood. *Chapter 3 in FPL-GTR-282*, pp.3-1.
4. Stevanovic, T., 2016. *Chemical composition and properties of wood* (pp. 49-106). Scrivener Publishing, Beverly, MA.
5. Niemz, P., Sonderegger, W., Keplinger, T., Jiang, J. and Lu, J., 2023. Physical properties of wood and wood-based materials. In *Springer handbook of wood science and technology* (pp. 281-353). Cham: Springer International Publishing.
6. Silva, J.L., Bordalo, R. and Pissarra, J., 2020. Wood identification: an overview of current and past methods. *Estudos de Conservacao e Restauro*, (12), pp.45-68.
7. Schmitt, U., Singh, A.P. and Kim, Y.S., 2021. Wood as an ecological niche for microorganisms: Wood formation, structure, and cell wall composition. In *Forest microbiology* (pp. 17-34). Academic Press.
8. Wiedenhoeft, A., 2010. Structure and function of wood. *Wood handbook: wood as an engineering material: chapter 3. Centennial ed. General technical report FPL; GTR-190. Madison, WI: US Dept. of Agriculture, Forest Service, Forest Products Laboratory, 2010: p. 3.1-3.18.*, *190*, pp.3-1.

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**75**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2

Total	**25**

Sample questions to Test Outcome

2 Mark Questions

1. Define *tracheids* and state their function in softwoods.
2. Differentiate between earlywood and latewood based on cellular structure.
3. List the three major chemical components of wood.
4. Name two mechanical properties affected by the orientation of wood fibers.
5. What macroscopic feature helps distinguish oak from pine?
6. Why is *microscopic analysis* essential for accurate wood identification?
7. Give one ecological role of wood in forest ecosystems.
8. Why is teak preferred for outdoor furniture?

6 Mark Questions

1. Given a wood sample with diffuse-porous vessels and abundant parenchyma, identify its likely hardwood group. Justify.
2. Compare the microscopic features of softwood (e.g., pine) and hardwood (e.g., oak) using labeled diagrams.
3. How do growth ring patterns (e.g., narrow vs. wide rings) correlate with mechanical strength? Use examples.
4. Predict the shrinkage behavior of a high-density wood (e.g., ebony) vs. low-density wood (e.g., balsa) when dried.
5. Why is bamboo structurally suitable for scaffolding despite being a grass? Link to its fiber arrangement.

14 Mark Questions

1. "Wood is a sustainable material for construction." Critically assess this statement.
2. Design a flowchart for a timber company to select the optimal wood species for manufacturing musical instruments.

Employability for the Course:

- *Wood Technologist*
- *Timber Grading Specialist*
- *Pulp & Paper Technologist*

KU3DSCFOR203 INTRODUCTION TO AGROFORESTRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCFOR203	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1		25	50	75	2
			Marks Distribution- Practical			
			10	15	25	

Course Description: This course provides a foundational understanding of agroforestry systems which include agroforestry systems classification, traditional and modern practices, species selection, design principles and policy framework. Students will explore the ecological, economic and social benefits of agroforestry practices, with a focus on sustainability, biodiversity conservation and climate resilience on forest ecosystems. Through theoretical learning and practical exercises, the course aims to equip students with the knowledge and skills necessary to assess and implement agroforestry strategiesin diverse landscapes.

Course Prerequisite

- Basic knowledge in Ecology at 10th level, Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand management of tree species along with agriculture crops.	***U***
2	Identify suitable species and design appropriate agroforestry models.	***A***
3	Analyze the environmental and socio-economic benefits of agroforestry.	***An***

4	Evaluate the role of agroforestry in sustainable agriculture and climate change mitigation.	***E***
5	Design suitable agroforestry practice based on demand and site conditions.	***©***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create ©***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔	✔					
CO 2			✔				
CO 3	✔	✔				✔	
CO 4					✔		✔
CO 5		✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: FUNDAMENTALS OF INDIAN AGRICULTURE & AGROFORESTRY (10 HOURS)**	
	1	Indian agriculture: structure, challenges, and land use planning.
	2	Introduction to Agroforestry: definition and objective
	3	Agroforestry classification: Structural, functional, socio-economic, and ecological.

	4	Importance and role of agroforestry in sustainable land use.
2	**MODULE TITLE: AGROFORESTRY SYSTEMS AND THEIR APPLICATIONS (15 HOURS)**	
	1	Silvoagriculture Systems:
		a) shifting cultivation
		b) Taungya system
		c) Plantation agriculture and plantation forestry
	2	Agrosilviculture Systems:
		a) Trees in crop fields, alley cropping
		b) Boundary planting and shaded commercial cropping
	3	Silvopastoral Systems**:**
		a) Grassland and tree management
		b) Protein banks
	4	Agrosilvopastoral Systems:
		a) Home gardens, windbreaks, shelterbelts
		b) Multipurpose tree gardens
3	**MODULE TITLE: CROP INTERACTION AND AGROFORESTRY MANAGEMENT (10 HOURS)**	
	1	Tree-crop interaction:
		a) Positive: mutualism, compatibility
		b) Negative: allelopathy, competition

	2	Interaction management:
		a) Aboveground & belowground
		b) Crown and root manipulation, spacing
	3	Tree and canopy management: Coppicing, thinning, pollarding, pruning
	4	Crop planning in agroforestry: Crop selection, nutrient, water, and weed management
4	**MODULE TITLE: AGROFORESTRY PRACTICES, POLICY, AND ORGANIZATIONS (10 HOURS)**	
	1	Multipurpose tree species: Characteristics desirable in agroforestry
	2	Canopy and tree architecture management: Lopping, hedging
	3	Pros and cons of agroforestry systems
	4	National Agroforestry Policy (2014)
	5	National and international agroforestry organizations
5	**Teacher Specific Module (30 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	5.6 Visit a local biome (e.g., a forest, grassland, or wetland) to observe and document biotic and abiotic factors. 5.7 Collect soil, water, and plant samples from different biomes for laboratory analysis of physical and chemical properties. 5.8 Use microscopes to examine soil microorganisms from different biomes. 5.9 Collect data on temperature, humidity, soil composition, and biodiversity from both temperate and tropical forests. 5.10 Assess species composition in different forest types using quadrat sampling. Space to fill the selected area/ activity	

Essential Readings:

1. Nair, P.K.R. 1993. An introduction to agroforestry. Kluwer Academic Publishers. 499 p.
2. Young, A. 1997. Agroforestry for soil management. CAB Intl. Wellingford.320p
3. Dwivedi, A.P. 1992. Agroforestry principles and practices. Oxford and IBH Publication Co.
4. SenSarma, P.K. and Jha, L.K. 1993. Agroforestry. Indian Perspectives. Ashish Publishers, Delhi
5. Patra A. 2013. Agroforestry: Principles and Practices, New India Publishing Agency, 260 p
6. Raj A. J. and S. B. Lal (eds.) 2013. Agroforestry-Theory and Practice. Scientific Publishers (India), Jodhpur
7. Huxley P. A. 1999. Tropical Agroforestry. Wiley: 384p.
8. Pathak P.S. and Ram Newaj (eds.) 2003. Agroforestry: Potentials and Opportunities. Agrobios, Jodhpur.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1
	3	1
	4	2
2	1	3
	2	3
	3	3
	4	2
	5	4
3	1	2
	2	2
	3	2
	4	4
	5	7

4	1	3
	2	7
	3	4
	4	8
	5	7

Suggested Readings:

- Odum, E.P. 1983. Basic Ecology. Saunders College Publishing, Holt Saunders, Japan
- Odum, E.P. Fundamentals of Ecology. Natraj Publisher, Dehradun
- Misra KC. Manual of Plant Ecology. Oxford & IBH Pub Co. New Delhi etc. 491p
- Michael P. Ecological Methods for Field and Laboratory Investigations. Tata McGraw-Hill Pub.Co. New Delhi, 404p
- Frankel, O.H., Brown, A.H.D., Burdon, J.J. 1995. The Conservation of Plant Biodiversity. Cambridge University Press. Cambridge. 299p
- Negi, S.S. 1993. Biodiversity and its Conservation in India. India Publishing company, New Delhi
- Saggwal, S.S. 1995. Forest Ecology of India. Pioneer Publishers, India. 368p

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		Marks
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. How does agroforestry differ from traditional agriculture?
2. Discuss the environmental benefits of agrosilvopastoral systems.
3. Discuss how agroforestry can contribute to climate change mitigation.
4. How does shelterbelt planting help in soil conservation?

6 Mark Questions

1. How can tree canopy management reduce crop competition?
2. Compare coppicing and pollarding as tree management strategies.
3. Compare functional and structural classifications of agroforestry.

14 Mark Questions

1. Analyse the benefits of integrating trees with crops in arid regions.
2. Analyse the ecological classification of agroforestry systems.
3. Evaluate the role of home gardens in biodiversity conservation.

Employability for the Course:

- Agroforestry Extension Officer

- Conservation Scientist
- Environmental Consultant
- Ecologist

KU3DSCFOR204 WILDLIFE MANAGEMENT

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCFOR204	4	75

<table>
<tr><td colspan="3">Learning Approach (Hours/ Week)</td><td colspan="3">Marks Distribution- Theory</td><td rowspan="2">Duration of ESE (Hours)</td></tr>
<tr><td>Lecture</td><td>Practical/ Internship</td><td>Tutorial</td><td>CE</td><td>ESE</td><td>Total</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">1</td><td rowspan="3"></td><td>25</td><td>50</td><td>75</td><td rowspan="3">2</td></tr>
<tr><td colspan="3">Marks Distribution- Practical</td></tr>
<tr><td>10</td><td>15</td><td>25</td></tr>
</table>

Course Description: This course introduces students to the principles, practices, and ethics of conservation biology, a multidisciplinary field addressing the protection and restoration of biodiversity. It explores the ecological, genetic, and biogeographical foundations of conservation, while emphasizing the critical role of in-situ and ex-situ strategies, protected area networks, and global and national conservation efforts. The course also discusses threats to biodiversity, causes of extinction, and real-world conservation case studies, equipping students with foundational knowledge for ecological research, policy-making, and environmental stewardship.

Course Prerequisite:

Basic knowledge in Wildlife Science (Level 100-199).

Course Outcomes:

CO No.	Expected Outcome	Learning Domains

1	Identify the fundamental concepts, principles, and objectives of wildlife management and major wildlife projects in India.	***R***
2	Apply various wildlife census and survey techniques to estimate population size and distribution.	***A***
3	Analyze different wildlife monitoring and tagging methods, including telemetry and visual marking.	***An***
4	Evaluate threats to wildlife, including trade, habitat loss, and man-wildlife conflict, and recommend mitigation strategies.	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔	✔			
CO 2	✔			✔			
CO 3	✔	✔					✔
CO 4	✔			✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: FUNDAMENTALS OF WILDLIFE MANAGEMENT (10 Hours)**	
	1	Definition and Scope of Wildlife Management

	2	Historical development of wildlife management in India
	3	Objectives of Wildlife Management
		g) Species conservation
		h) Habitat preservation
		i) Conflict mitigation
	4	Principles and approaches
		a) Preservation vs. management
		b) In-situ and ex-situ conservation
		c) Adaptive management
		d) Conservation projects in India
2	**MODULE TITLE: WILDLIFE CENSUS AND SURVEY TECHNIQUES (12 Hours)**	
	1	Purpose and importance of wildlife census
	2	Census Techniques
		a) Direct and Indirect methods
		b) Sample counts and total counts
		c) Encounter rates and indices
	3	Census Methods
		a) Block counts & Roadside counts
		b) Dung counts & Pugmark census
		c) Waterhole census & Line transect
		d) Capture-mark-recapture method
	4	Traps Used in Wildlife Surveys

		a) Sherman traps
		b) Mist nets
		c) Funnel trapping
		d) Glue trapping
		e) Pitfall traps
3	**MODULE TITLE: WILDLIFE MONITORING (12 Hours)**	
	1	Wildlife monitoring techniques
		a) Radio and satellite telemetry
		b) Visual tagging
		c) Bird ringing: methods and significance
	2	Darting and Chemical Immobilization
		a) Purpose and significance in wildlife management
		b) Types of darts and darting guns
		c) Common tranquilizers, anaesthetics, and drug combinations
		d) Ethical concerns and guidelines (IWRC, CZA protocols)
	3	Wildlife Trade and its Impact
		a) Overview of illegal wildlife trade
		b) CITES and its functioning
		c) TRAFFIC: objectives and role
4	**MODULE TITLE: CONSERVATION BIOLOGY (15 Hours)**	
	1	Principles and Ethics of Conservation
	2	Endemism, Rarity, and Species Extinction

	3	IUCN Red List categories and criteria
	4	Captive breeding programmes, introduction and reintroduction – case studies.
5	**Teacher Specific Module (30 Hours)**	
	• *Visit to ex-situ and in-situ conservation approaches* • *Field Training in Census techniques – Line transect survey, pitfall traps, Sherman trapping, mistnetting, camera trapping, pugmark analysis* • *Wildlife survey methods – visual encounter survey, open and bounded quadrat sampling, stream line survey, belt transects, glue trapping, mistnetting, Sherman trapping, funnel trapping, cover board survey, bat detectors, mark-recapture surveys, radio-collaring and telemetry studies.* • *Use of software for analysis of census data*	
	Space to fill the selected area/ activity	

Essential Readings:

1. Berwick, S.H. and Saharia, V.B. 1995. Wildlife Research and Management. OUP, New
2. Dasmann, R.F. 1982. Wildlife Biology.
3. Davil, J.W. et al. (1981). Infectious diseases of wild mammals. Ed. II. Iowa State University Press, USA.
4. Karanth, K.U. and Nichols, J.D. eds., 2002. Monitoring tigers and their prey: a manual for researchers,
5. managers, and conservationists in tropical Asia (pp. 121-138). Bangalore, India: Centre for Wildlife Studies.
6. Krebs C & Davis N. (1978). Introduction to behavioral ecology. Oxford University Press
7. Lever, C. (1985). Naturalised mammals of the world. John Wiley, London
8. Mills, L. S. (2013). Conservation of Wildlife Populations Demography, Genetics and Management (Ed.2).
9. Wiley-Blackwell.
10. Rajesh, G. Fundamentals of Wildlife Management, Justice Home, Allahabad.
11. Reena Mathur. 1985. Animal Behaviour. OUP, Delhi.481pp.
12. Sawarkar B. Wildlife Management. WII. Dehra Dun
13. Sukumar, R. Asian Elephant. Ecology and Management. OUP Cambridge.

14. Wodroffe, G. 1981. Wildlife conservation and modern zoo. Saiga Publishing Co., England.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3
	4	4
2	1	5
	2	6
	3	6
3	1	7
	2	8
	3	9,10
4	1	11
	2	12

Suggested Readings:

Auk Bioone Wildlife Management Journal, Current Science, European Journal of Wildlife Research, Journal of biodiversity, bioprosperity and management, Journal of Threatened Taxa, Journal of Wildlife Management, Journal of Wildlife Rehabilitation, Wildlife Biology, Wildlife Research, Wildlife Society Bulletin.

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. Define wildlife management.
2. Name two direct methods used in wildlife census.
3. What is telemetry in wildlife monitoring?
4. Mention one major wildlife project in India.
5. List two threats to wildlife.

6 Mark Questions

1. Explain the difference between sample count and total count methods in wildlife census.
2. Describe the role of protected areas in wildlife conservation in India.
3. Discuss the importance of indirect methods like dung counts and pugmark census in wildlife surveys.
4. Explain the concept of man-wildlife conflict and suggest two mitigation measures.
5. Describe the principle and applications of radio telemetry in wildlife studies.

14 Mark Questions

1. Discuss the different methods of wildlife census and their respective advantages and limitations.
2. Explain the role of CITES and TRAFFIC in regulating wildlife trade and conserving endangered species.
3. Critically evaluate the threats faced by wildlife in the Western Ghats and the conservation strategies implemented to mitigate these threats.
4. Describe the process, importance, and ethical considerations of chemical immobilization (darting) in wildlife management.
5. Elaborate on the structure and significance of the protected area network in India, highlighting the role of national parks, wildlife sanctuaries, and community reserves.

KU3VACFOR220 BASIC LIFE SUPPORT SKILLS AND FIRST AID

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	VAC	200-299	KU3VACFOR220	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/	Tutorial	CE	ESE	Total	

	Internship					
3	0		35	65	100	1.5

Course Description: Basic Life Support Skills and First Aid is a foundational course designed to equip students with essential knowledge and practical skills to respond effectively in emergency situations. The course offers a comprehensive introduction to the principles of first aid, cardiopulmonary resuscitation (CPR), and basic life support techniques. Emphasizing the importance of timely and informed intervention, students will learn to assess and manage common medical emergencies, injuries, and life-threatening conditions with confidence and composure. Through hands-on training and scenario-based learning, the course fosters critical thinking, preparedness, and a sense of responsibility in safeguarding individual and community health and safety.

Course Prerequisite:

Basic knowledge in Biology at 10th level, Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Identify common medical emergencies and the appropriate first aid responses	***R***
2	Identify common medical emergencies and the appropriate first aid responses	***A***
3	Analyze emergency situations to prioritize care and make informed decisions	***An***
4	Evaluate the effectiveness of first aid interventions in various real-life scenarios	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔	✔			
CO 2	✔			✔			
CO 3	✔	✔					✔
CO 4	✔			✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: UNDERSTANDING FIRST-AID PROCEDURES (5 HOURS)**	
	1	What is First Aid?
		d) Good Samaritan Law
		e) Items you'll need in a medical kit.
		f) Personal Protective Equipment.
2	**MODULE TITLE: EMERGENCY SITUATIONS AND FIRST AIDS (20 HOURS)**	
	1	Wounds and treatment for each type:
		a) Open Chest Wounds & Punctured Wounds
		b) Amputations, Cuts & Scrapes,

		c) Fractures, Sprains & Strains
	2	Other Emergency Situations and First Aids
		a) Types of Burns
		b) Poisoning
		c) Hemorrhages & Hypoglycemia.
		d) Choking & Dehydration
		e) Shocks, Seizures & Strokes
		f) Snake Bite
3	**MODULE TITLE: CARDIOPULMONARY RESUSCITATION (CPR) (10 HOURS)**	
	1	Understanding CPR
		a) Definition and importance of CPR
		b) Indications and goals of CPR
		c) Chain of survival concept
	2	Automated External Defibrillator (AED)
		a) Components and functions of an AED
		b) Steps in using an AED safely and effectively
		c) Integration of AED with CPR
4	**MODULE TITLE: ESSENTIAL LIFE-SAVING TECHNIQUES (10 Hours)**	
	1	Hands-Only CPR
		a) Identifying cardiac arrest
		b) Chest compression technique: position, depth, and rhythm

		c) Practicing uninterrupted compressions
	2	Artificial Respiration and Full CPR
	3	Heimlich Maneuver (Abdominal Thrusts)
	4	Dressing Open Wounds
	5	Temporary Immobilization of Limb Fractures
5	**Teacher Specific Module**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	Space to fill the selected area/ activity	

Essential Readings:

1. **American Heart Association (AHA).** *Basic Life Support (BLS) Provider Manual*.– Latest edition.
2. **St. John Ambulance, British Red Cross, and St. Andrew's First Aid.** *First Aid Manual: The Authorised Manual of St. John Ambulance*.
3. **International Federation of Red Cross and Red Crescent Societies (IFRC).** *First Aid Guidelines*.
4. **National Safety Council (NSC).** *First Aid, CPR, and AED Standard*.
5. **World Health Organization (WHO).** *Emergency and Essential Surgical Care: First Aid Manual*.
6. **Dr. R.S. Gopalan.** *Emergency First Aid and Management of Common Injuries*.
7. **National Institute of Disaster Management (India).** *First Aid and Emergency Care Training Manuals*.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3
	4	4
2	1	5
	2	6
	3	6
3	1	7
	2	8
	3	9,10
4	1	11
	2	12

Suggested Readings:

1. **First Aid Manual** By St. John Ambulance, St. Andrew's First Aid, and British Red Cross. – Step-by-step guide to first aid procedures with illustrations and real-life scenarios.

Assessment Rubrics:

Evaluation Type	Marks
End Semester Evaluation	**65**
Continuous Evaluation	**35**

a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2-MARK QUESTIONS

1. Define first aid.
2. What is the Good Samaritan Law?
3. Name any four items commonly found in a first aid kit.
4. Mention two examples of Personal Protective Equipment (PPE).
5. What is an open chest wound?
6. List two signs of a fracture.
7. What is hypoglycemia?
8. Define the term CPR.
9. State any two functions of an AED.
10. What is the "Chain of Survival" in CPR?

6-MARK QUESTIONS

1. Explain the steps to manage a puncture wound and an open chest wound.
2. Compare the first aid measures for cuts & scrapes vs. amputations.
3. Discuss the different types of burns and the appropriate first aid for each.
4. Describe the symptoms and first aid management of a person suffering from poisoning.
5. Explain the steps involved in performing hands-only CPR.
6. Differentiate between artificial respiration and full CPR with procedures.
7. Describe the use and safety precautions of an Automated External Defibrillator (AED).
8. Analyze the first aid procedures for shock and seizures.

9. Describe the technique of dressing open wounds.
10. What steps should be taken to temporarily immobilize a suspected limb fracture?

14-MARK QUESTIONS

1. A person is found unconscious with no signs of breathing. Explain how you would assess the situation and perform CPR, including the use of an AED.
2. Create a detailed first aid plan for managing a person with multiple injuries including a fracture, bleeding wound, and suspected hypoglycemia.
3. Evaluate the importance of the “Chain of Survival” and describe how each link contributes to saving lives.
4. You are the first responder to a burn victim and another person who has inhaled poisonous fumes. Discuss the differences in assessment and first aid procedures in both cases.
5. Demonstrate your understanding of essential life-saving techniques by explaining the Heimlich maneuver, temporary immobilization of fractures, and artificial respiration procedures in a mass casualty scenario.
6. Discuss in detail how to respond to three life-threatening emergencies: choking, snakebite, and stroke. Include signs, symptoms, and first aid steps for each.

KU3VACFOR221 FIELD ETIQUETTES IN FORESTRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	VAC	200-299	KU3VACFOR221	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: This course is designed to inculcate essential field etiquettes among forestry students and professionals. It emphasizes respectful behaviour, safety protocols, environmental ethics, and effective communication while working in forest ecosystems. The course prepares students for professional field conduct aligned with legal, ecological, and cultural sensitivities.

Course Prerequisite:

Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Recognize the importance of appropriate behaviour and discipline during forestry fieldwork.	***R***
2	Demonstrate adherence to safety measures and environmental ethics in various forest environments.	***A***
3	Analyse legal frameworks and their relevance to ethical field conduct and biodiversity conservation.	***An***
4	Develop professional documentation, communication, and stakeholder engagement skills for fieldwork.	***C***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔				
CO 2				✔			
CO 3		✔					✔
CO 4				✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: INTRODUCTION TO FIELD DISCIPLINE AND BEHAVIOUR (5 HOURS)**	
	1	Importance of Field Etiquette in Forestry
		a) Role in safety
		b) Essential Safety Gear for Forestry Operators
		c) Conservation and professionalism
	2	Respect for Nature and Local Communities
		a) Cultural sensitivity and awareness in tribal and rural landscapes
		b) Common ethical and behavioural guidelines
2	**MODULE TITLE: SAFETY PROTOCOLS AND PERSONAL CONDUCT (20 HOURS)**	

	1	Personal Safety Measures
		a) Personal Protective Equipment
		b) Protection of Legs and Feet
	2	First Aid Awareness
		a) Chemical hazards
		b) Biological hazards
	3	Forest fire management and control
	4	Ergonomics
	5	Wildlife Encounters and Risk Management
3	**MODULE TITLE: ENVIRONMENTAL ETHICS AND LEGAL COMPLIANCE (10 HOURS)**	
	1	Leave No Trace Principles
		a) Waste disposal, minimizing impact, avoiding disturbance
	2	Code of Conduct in Protected Areas
		a) Respecting boundaries, no collection zones, permits
4	**MODULE TITLE: SAFETY AND HEALTH IN FORESTRY (10 HOURS)**	
	1	Occupational Health and Safety Assessment Series
		a) Regulations concerning Safety and Health Standard
		b) OHSAS 18000
	2	Classification of Accidents
	3	Medical Supervision and Care
	4	First Aid

5	**Teacher Specific Module**
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.
	Space to fill the selected area/ activity

Essential Readings:

1. Apud E., Bostrand L., Mobbs I. & Strehlke B. 1989. Guidelines on ergonomic study in forestry. Geneva, Switzerland, International Labour Organization.
2. Apud, E. & Meyer, F. 2004. Ergonomics. In J. Burley, J. Evans & J.A., Youngquist, eds. Encyclopaedia of Forest Sciences, 2: 639–645.
3. Axelson, O. 1974. Heat stress in forest work: an attempt to evaluate the physical work capacity of forest workers as influenced by a hot climate. Rome, FAO Swedish Funds-in-Trust, No. 74. 31 pp.
4. FAO/ECE/ILO. 1999. Improving working conditions and increasing productivity in forestry. Seminar proceedings. Zvolen, Slovakia, Forest Research Institute.
5. FAO/ECE/ILO. 1996. Safety and health in forestry are possible. Seminar and workshop proceedings, Komolfingen, Switzerland. Bern, Federal Office of Environment, Forests and Landscape.
6. FAO & ILO. 1980. The chainsaw in tropical forest. Rome, FAO.
7. Poschen, P. 1993. Forestry, a healthy and safe profession. Unasylva, 44(172): 3–12. Rome, FAO.
8. Staal-Wasterlund, D. 1998. A review of heat stress research with application to forestry. Applied Ergonomics, 29(3): 179–183.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3
	4	4

2	1	5
	2	6
	3	6
3	1	7
	2	8
	3	9,10
4	1	11
	2	12

Suggested Readings:

1. International Labour Organization. 2011a. Forestry. In P. Poschen, ed. Encyclopaedia of Occupational Safety & Health, 68. (available at http://www.ilo.org/oshenc/part-x/forestry)

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2

Total	**100**

Sample questions to Test Outcome

2 Marks Questions (Short Answer Type)

1. What is the role of field etiquette in ensuring safety during forestry operations?
2. Define 'Leave No Trace' in the context of forestry fieldwork.
3. Mention any two essential personal protective equipment used in the field.
4. What is the significance of respecting local communities during field visits?
5. List any two chemical hazards commonly encountered during forestry surveys.
6. What do you mean by “No Collection Zones”?
7. State any two precautions to be taken while encountering wild animals during fieldwork.
8. What is OHSAS 18000?

6 Marks Questions

1. Explain the importance of cultural sensitivity while conducting fieldwork in tribal or rural areas.
2. Describe the major components of a personal safety protocol for forestry students.
3. Discuss the significance and proper use of first aid during field emergencies.
4. How can ergonomics reduce the risk of injury during forest surveys?
5. Describe the methods of fire control in forest areas and how a student should respond to a fire situation.
6. Outline the key principles of the ‘Leave No Trace’ approach and its relevance to sustainable forestry.
7. Discuss the ethical responsibilities of students working in protected areas.

14 Marks Questions

1. Elaborate on the various types of personal safety measures a forestry student must adopt during fieldwork. Illustrate with examples.
2. Discuss in detail the ethical, cultural, and professional aspects of field behavior in forestry, and how these contribute to conservation and community relationships.
3. Analyze the various risks and hazards involved in forestry fieldwork and explain the strategies to manage them effectively, including first aid, ergonomics, and wildlife encounters.
4. Explain the legal frameworks, field discipline norms, and safety standards applicable to forestry fieldwork. How do they ensure professional conduct and personal well-being?

KU4DSCFOR206 FOREST UTILIZATION

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	DSC	200-299	KU4DSCFOR206	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1		25	50	75	2
			Marks Distribution- Practical			
			10	15	25	

Course Description: This course introduces students to the science and techniques involved in the harvesting and utilization of forest resources. It covers traditional and mechanized methods of timber logging, conversion, transportation, and storage. Students will explore the manufacturing processes and applications of various wood products. The course also highlights the significance of Non-Timber Forest Products (NTFPs) focusing on their industrial value and role in local economies. Emphasis is placed on sustainable practices and value addition in forest resource management.

Course Prerequisite

- Must studied wood structure and functions, Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the principles and techniques of timber harvesting, conversion, and transportation, including reduced impact logging and timber storage methods.	***U***
2	Apply knowledge of manufacturing processes to produce various wood-based and composite products such as veneers, plywood, fiberboards, and improved wood types.	***A***

3	Analyse the properties, uses, and industrial relevance of Non-Timber Forest Products (NTFPs) especially in the context of India and Kerala.	***An***
4	Evaluate the economic and ecological significance of forest-based products with a focus on their sustainable use and value addition.	***E***
5	Create innovative solutions or product concepts using timber and non-timber resources, incorporating sustainable practices and modern processing techniques	***©***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create ©***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔	✔					
CO 2							
CO 3	✔	✔			✔	✔	
CO 4			✔		✔		✔
CO 5		✔			✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: LOGGING AND TIMBER HANDLING (10 HOURS)**	
	1	Felling
		a) Principles of tree felling, conversion and log making.

		b) Methods of felling and felling rules
		c) Reduced Impact Logging
	2	Mechanized harvesting systems
		a) Felling equipments,
		b) Extraction equipments
		c) Loading equipments.
	3	Timber transportation
	4	Storage of timber and timber depots
2	**MODULE TITLE: MANUFACTURING OF WOOD PRODUCTS (15 HOURS)**	
	1	Composite Wood Products
		a) Plywood
		b) Fibreboard
		c) Particle board
		d) Hardboard
	2	Adhesives in Wood Industry
		c) Natural adhesives
		d) Synthetic adhesives
	3	Improved Wood
		c) impregnated wood
		d) heat stabilized wood
		e) compressed wood

		f) compregnated wood
		g) heat stabilized compressed wood
		h) chemically modified wood
	4	Wood based composites
		c) wood plastic composites
		d) wood metal composites
	5	Cellulose-Derived Products
		a) Paper and Pulp
		b) rayon
	6	Destructive Distillation of Wood
	7	Saccharification of Wood
3	**MODULE TITLE: WOOD BASED INDUSTRIES (10 HOURS)**	
	1	Major wood industries – sawn timber, paper and pulp, plywood aqnd particle board, matchwood
	2	Other wood-based industries – Packing case, dendro-biomass power generation industries and value addition industries
	3	Constraints in wood based industries – wood demand and supply
	4	Measures for development of wood based industries – technological measures, precision silviculture technology, value addition technology, And contract farming
4	**MODULE TITLE: NON-TIMBER FOREST PRODUCTS, MEDICINAL AND AROMATIC PLANTS (10 HOURS)**	
	1	Introduction to NTFPs: Definition, significance in rural and industrial economies

	2	Major NTFPs of India and Kerala
		a) Fodder, Canes, and Bamboos
		b) Oils and Oleoresins
		c) Gums and Resins
		d) Tans and Dyes
		e) Fibres and flosses
		f) Animal derived products
	3	Important aromatic and medicinal plants in Kerala
		a) Aromatic plants- lemon grass, citronella, vetiver, eucalyptus and mint
		b) Medicinal plants – *santalum album, Rauolfia serpentine, saraca ashoka, cassia fistula, embilica officinalis, Terminalia spp, wrightia tinctorea,and holarrhena pubescens*
5	**Teacher Specific Module (5 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	5.11 Visits to the following wood based industries to learn the manufacturing procedures 5.12 Visit to a sawmill or timber depot to observe log conversion and storage 5.13 Field trip: Visit a paper mill, match factory, or biomass unit 5.14 Survey: Local timber and sawn wood market – pricing, demand-supply analysis 5.15 Guest lecture: From a wood industry expert or forest department official 5.16 Market study**:** Survey local NTFP-based products (e.g., beedi leaves, gums)	

Essential Readings:

1. Mehta, T. 1981. A Handbook of Forest Utilization. International Book Distributors. 208 p.

2. John G. Haygreen, Jim L. Bowyer. 1996. Forest Products and Wood Science, an Introduction.
3. Rao, P.S. 1988. A Handbook on Indian Wood and Wood Panels, Solid Wood. Oxford University Press.
4. Brown HP. 1985. A Manual of Indian Wood Technology.
5. Desch, H. E and Dinwoodie, J.M. 1981. Timber: Its Structure, Properties and Utilization. The Macmillan Press. Indian Forest Utilization. Vol I and II. Forest Research Institute Dehra Dun
6. Rydhom S.A. 1965. Pulping process inter Science Publishers. New York
7. K.W. Brit. Hand Book of pulp and paper technology. C.B.S. Publication New Delhi.
8. Nair K.K.N. 2000. Manual of Non-wood Forest produce plants of Kerala. Kerala Forest Department Government of Kerala, Thiruvananthapuram. 449 p.
9. Krishnamurthy, T. Minor Forest Products of India. Oxford & IBH Publishing Co. Pvt. Ltd. 645 p.
10. Sharma, L.C. 1988. The Indian Pulp and Paper Industry at a glance. Bishen Singh Mahendra PalSingh, Dehradun. 280p.
11. Singh, M.P. 2011. Wild Medicinal Plants. Daya Publishing House. 368p
12. Jain, S. K. 1995. A manual of Ethnobotany. Scientific publishers. 193 p

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1
	3	1
	4	2
2	1	3
	2	3
	3	3
	4	2
	5	6
	6	7
	7	4
3	1	6

	2	6
	3	2
	4	4
4	1	8
	2	11
	3	12

Assessment Rubrics:

Evaluation Type – Theory		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4

c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

1. Describe the methods of timber felling and the general felling rules followed in Kerala.
2. Explain the process of veneer manufacturing and its various types.
3. Describe the major non-timber forest products (NTFPs) of Kerala and their uses.
4. List the steps involved in the mechanized harvesting of timber.
5. Describe the importance of medicinal plants like Rauvolfia serpentina and Phyllanthus emblica in Ayurveda.

6 Mark Questions

1. Compare the characteristics, manufacturing processes, and uses of plywood, fibre board, and particle board.
2. Differentiate between essential and non-essential oils in terms of sources, extraction, and applications.
3. Compare gum and resin in terms of plant origin, classification, and industrial uses.

14 Mark Questions

1. Analyze the impact of Reduced Impact Logging (RIL) on forest sustainability.
2. Examine the role of composite wood industries in reducing dependence on natural forests.
3. Analyze the factors affecting the demand and supply gap in the wood-based industry in India.
4. What are the economic and ecological implications of overexploitation of NTFPs in Kerala?

Employability for the Course:

- Scientist
- Technician, quality control assistant, production supervisor (plywood, particle board, veneer units)
- Raw material manager, technical operator in Pulp and Paper Industry

KU4DSCFOR207 WILDLIFE MANAGEMENT AND CONSERVATION BIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	DSC	200-299	KU4DSCFOR207	4	75

<table>
<tr><td colspan="3">Learning Approach (Hours/ Week)</td><td colspan="3">Marks Distribution- Theory</td><td rowspan="2">Duration of ESE (Hours)</td></tr>
<tr><td>Lecture</td><td>Practical/ Internship</td><td>Tutorial</td><td>CE</td><td>ESE</td><td>Total</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">1</td><td rowspan="3"></td><td>25</td><td>50</td><td>75</td><td rowspan="3">2</td></tr>
<tr><td colspan="3">Marks Distribution- Practical</td></tr>
<tr><td>10</td><td>15</td><td>25</td></tr>
</table>

Course Description: This course introduces students to the principles, practices, and ethics of conservation biology, a multidisciplinary field addressing the protection and restoration of biodiversity. It explores the ecological, genetic, and biogeographical foundations of conservation, while emphasizing the critical role of in-situ and ex-situ strategies, protected area networks, and global and national conservation efforts. The course also discusses threats to biodiversity, causes of extinction, and real-world conservation case studies, equipping students with foundational knowledge for ecological research, policy-making, and environmental stewardship.

Course Prerequisite:

Basic knowledge in Wildlife Science (Level 100-199).

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Identify the fundamental concepts, principles, and objectives of wildlife management and major wildlife projects in India.	***R***
2	Apply various wildlife census and survey techniques to estimate population size and distribution.	***A***
3	Analyze different wildlife monitoring and tagging methods, including telemetry and visual marking.	***An***

4	Evaluate threats to wildlife, including trade, habitat loss, and man-wildlife conflict, and recommend mitigation strategies.	***E***

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓	✓			
CO 2	✓			✓			
CO 3	✓	✓					✓
CO 4	✓			✓		✓	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: FUNDAMENTALS OF WILDLIFE MANAGEMENT (10 Hours)**	
	1	Definition and Scope of Wildlife Management
	2	Historical development of wildlife management in India
	3	Objectives of Wildlife Management
		j) Species conservation
		k) Habitat preservation
		l) Conflict mitigation

	4	Principles and approaches
		e) Preservation vs. management
		f) In-situ and ex-situ conservation
		g) Adaptive management
		h) Conservation projects in India
2	**MODULE TITLE: WILDLIFE CENSUS, MONITORING, AND CONSERVATION TECHNIQUES (15 Hours)**	
	1	Wildlife Census Methods
		d) Purpose and significance of wildlife census
		e) Census techniques using direct and indirect methods
		f) Sample counts, total counts, encounter rates and indices
		g) Census methods - block counts, roadside counts, dung counts, pugmark census, waterhole census, line transect, and capture-mark-recapture method.
	2	Wildlife Monitoring and Survey Tools
		e) Monitoring techniques - radio and satellite telemetry, visual tagging, bird ringing
		f) Significance of monitoring techniques
		g) Traps used in wildlife surveys - Sherman traps, mist nets, funnel trapping, glue trapping, and pitfall traps.
	3	Darting, Chemical Immobilization, and Ethical Guidelines
		d) Purpose and significance in wildlife management, and ethical concerns and guidelines following IWRC and CZA protocols.
		e) Darting methods, types of darts and darting guns, common tranquilizers, anaesthetics, and drug combinations,
		f) Ethical concerns and guidelines following IWRC and CZA protocols.

	4	Wildlife Trade and Conservation Measures
		a) Overview of illegal wildlife trade
		b) CITES and its functioning
		c) TRAFFIC - objectives and role in conservation.
3	**MODULE TITLE: BIODIVERSITY EXTINCTION AND CONSERVATION APPROACHES (10 Hours)**	
	1	Perspectives and Expressions in Biodiversity Conservation
		a) Identification and prioritization of ecologically sensitive areas (ESA)
		b) Understanding biodiversity conservation at regional and national levels
		c) Application of coarse filter and fine filter approaches
	2	Population Viability Analysis and Conservation Planning
		d) Population viability analysis (PVA) - concept
		e) Applications of PVA models in management decisions for small populations
		f) Strategies for ensuring minimum viable populations and recovery of threatened species.
4	**MODULE TITLE: CONSERVATION BIOLOGY (14 Hours)**	
	1	Principles and Ethics of Conservation
		a) Ex-situ and in-situ methods of conservation
		b) Protected areas - Concept and examples in Kerala and India
	2	Endemism, Rarity, and Species Extinction
	3	IUCN Red List categories and criteria

	4	Captive breeding programmes, introduction and reintroduction – case studies.
5	**Teacher Specific Module (30 Hours)**	
	• *Visit to ex-situ and in-situ conservation approaches* • *Field Training in Census techniques – Line transect survey, pitfall traps, Sherman trapping, mistnetting, camera trapping, pugmark analysis* • *Wildlife survey methods – visual encounter survey, open and bounded quadrat sampling, stream line survey, belt transects, glue trapping, mistnetting, Sherman trapping, funnel trapping, cover board survey, bat detectors, mark-recapture surveys, radio-collaring and telemetry studies.* • *Use of software for analysis of census data*	
	Space to fill the selected area/ activity	

Essential Readings:

1. Berwick, S.H. and Saharia, V.B. 1995. Wildlife Research and Management. OUP, New
2. Dasmann, R.F. 1982. Wildlife Biology.
3. Davil, J.W. et al. (1981). Infectious diseases of wild mammals. Ed. II. Iowa State University Press, USA.
4. Karanth, K.U. and Nichols, J.D. eds., 2002. Monitoring tigers and their prey: a manual for researchers,
5. managers, and conservationists in tropical Asia (pp. 121-138). Bangalore, India: Centre for Wildlife Studies.
6. Krebs C & Davis N. (1978). Introduction to behavioral ecology. Oxford University Press
7. Lever, C. (1985). Naturalised mammals of the world. John Wiley, London
8. Mills, L. S. (2013). Conservation of Wildlife Populations Demography, Genetics and Management (Ed.2).
9. Wiley-Blackwell.
10. Rajesh, G. Fundamentals of Wildlife Management, Justice Home, Allahabad.
11. Reena Mathur. 1985. Animal Behaviour. OUP, Delhi.481pp.
12. Sawarkar B. Wildlife Management. WII. Dehra Dun
13. Sukumar, R. Asian Elephant. Ecology and Management. OUP Cambridge.
14. Wodroffe, G. 1981. Wildlife conservation and modern zoo. Saiga Publishing Co., England.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
	3	3
	4	4
2	1	5
	2	6
	3	6
3	1	7
	2	8
	3	9,10
4	1	11
	2	12

Suggested Readings:

Auk Bioone Wildlife Management Journal, Current Science, European Journal of Wildlife Research, Journal of biodiversity, bioprosperity and management, Journal of Threatened Taxa, Journal of Wildlife Management, Journal of Wildlife Rehabilitation, Wildlife Biology, Wildlife Research, Wildlife Society Bulletin.

Assessment Rubrics:

Evaluation Type – Theory		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**
Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

6. Define wildlife management.
7. Name two direct methods used in wildlife census.
8. What is telemetry in wildlife monitoring?
9. Mention one major wildlife project in India.
10. List two threats to wildlife.

6 Mark Questions

6. Explain the difference between sample count and total count methods in wildlife census.
7. Describe the role of protected areas in wildlife conservation in India.
8. Discuss the importance of indirect methods like dung counts and pugmark census in wildlife surveys.
9. Explain the concept of man-wildlife conflict and suggest two mitigation measures.
10. Describe the principle and applications of radio telemetry in wildlife studies.

14 Mark Questions

6. Discuss the different methods of wildlife census and their respective advantages and limitations.
7. Explain the role of CITES and TRAFFIC in regulating wildlife trade and conserving endangered species.
8. Critically evaluate the threats faced by wildlife in the Western Ghats and the conservation strategies implemented to mitigate these threats.
9. Describe the process, importance, and ethical considerations of chemical immobilization (darting) in wildlife management.
10. Elaborate on the structure and significance of the protected area network in India, highlighting the role of national parks, wildlife sanctuaries, and community reserves.

KU4DSCFOR208 FOREST GENETICS AND BIOTECHNOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	DSC	200-299	KU4DSCFOR208	4	75

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1		25	50	75	2
			Marks Distribution- Practical			
			10	15	25	

Course Description: This course introduces students to the fundamental concepts and applications of forest genetics, tree improvement, and biotechnology in forestry. It explores the genetic, environmental, and phenotypic expressions of trees while emphasizing breeding methods, selection strategies, and hybridization techniques for enhancing forest productivity. Students will engage with cutting-edge approaches in plant tissue culture, genetic engineering, and conservation genetics, gaining insight into the role of biotechnology in sustainable forestry. The course also examines challenges in in-vitro propagation, transgenic varieties, and germplasm preservation, equipping students with essential knowledge for forestry research, policy development, and tree breeding programs.

Course Prerequisite:

Basic knowledge in Plant reproduction and growth (Level 100-199).

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the genetic, environmental, and phenotypic expression of trees.	***R***
2	Explain the significance of tree improvement and its role in forestry.	***U***
3	Apply various tree breeding methods, including selection, hybridization, and introduction.	***A***

4	Analyse plant tissue culture techniques and their applications in forestry.	***An***
5	Evaluate genetic engineering approaches and their impact on forest conservation.	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓	✓			
CO 2	✓			✓			
CO 3	✓	✓					✓
CO 4	✓			✓		✓	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: FOREST GENETICS (10 Hours)**	
	1	Reproduction and Genetic Expression in Forest Trees
		a) Anthesis and pollination in forest trees
		b) Importance of reproductive processes in tree breeding
		c) Genetic, environmental, and phenotypic expression of trees
		Principles of Quantitative Genetics in Forestry

	2	a) Quantitative inheritance in trees
		b) Heritability, genetic advance, and genetic gain
		c) Combining ability and its application in tree breeding
2	**MODULE TITLE: TREE IMPROVEMENT AND BREEDING METHODS (16 Hours)**	
	1	Fundamentals of Tree Improvement
		h) Introduction, history, and development of tree improvement
		i) Genetic basis of tree breeding and natural variability in trees
		j) Forces influencing variability in tree populations
	2	Tree Breeding Methods and Applications
		h) Selection, hybridization, and introduction
		i) Exotic forestry and provenance testing
		j) Seed production areas, seed orchards, progeny trials, and seed orchard improvement
	3	Advanced Breeding Strategies in Forestry
		g) Backcross breeding and heterosis breeding
		h) Clonal forestry and vegetative propagation techniques
		i) Breeding for resistance against insect pests, diseases, and air pollution
		j) Breeding for improved wood properties
	4	Conservation and Genetic Resource Management
		d) Conservation of forest tree germplasm
		e) Applications of tree breeding in forestry
		f) Conservation strategies for rare and threatened species

3	**MODULE TITLE: PLANT TISSUE CULTURE (12 Hours)**	
	1	Principles and Techniques of Tissue Culture
		d) Introduction, advantages, and historical developments
		e) Tissue culture techniques and explant collection
		f) Culture media: types and components
	2	Sterilization and Laboratory Protocols
		g) Sterilization of living and non-living materials
		h) Inoculation, incubation, hardening, and planting-out procedures
	3	Pathways of Plant Regeneration
		a) Organogenesis and somatic embryogenesis
		b) Synthetic seeds and embryo culture significance
		c) Protoplast isolation and culture
	4	Clonal Propagation and Hybridization Techniques
		a) Somatic hybridization and clonal multiplication
		b) Applications of tissue culture in forestry improvement
4	**MODULE TITLE: GENETIC ENGINEERING IN FORESTRY (12 Hours)**	
	1	In-vitro Propagation and Challenges
		c) Problems of in-vitro propagation
		d) Applications of in-vitro techniques in forestry
	2	Genetic Engineering and Biotechnological Applications
		a) Genetic engineering principles and recombinant DNA technology
		b) Applications in forestry and tree improvement

	3	Transgenic Varieties and Conservation Strategies
		a) Development and use of transgenic forest species
		b) Germplasm preservation strategies: short-, medium-, and long-term storage
	4	Ethical Considerations and Future Prospects
		a) Ethical concerns in genetic modification
		b) Biotechnological advancements in conservation forestry
5	**Teacher Specific Module (30 Hours)**	
	• *Visit to Tissue culture laboratories* • *Practical Training in Tree Breeding Methods – Plus tree selection, Provenance test, Hybridization and production* • *Visit to tree improvement centers, seed orchards, and clonal forestry sites* • *Hands-On Training in Tissue Culture Techniques - Explant collection and sterilization procedures, Preparation of culture media and inoculation techniques* • *Use of bioinformatics tools for analysis of genetic diversity*	
	Space to fill the selected area/ activity	

Essential Readings:

1. FAO. 1985. Forest Tree Improvement, FAO Pub.
2. Mandal AK & Gibson GL. (Eds.). 1997. Forest Genetics and Tree Breeding. CBS.
3. Surendran C, Sehgal RN and Parmathama M. (eds). 2003. A Text Book of Forest Tree Breeding. ICAR.
4. Zobel BJ and Talbert J. 1984. Applied Forest Tree Improvement. John Wiley & Sons.
5. Gupta, P.K. 2000. Molecular Biology and Genetic Engineering. Rastogi Publ. New Delhi
6. Kumar, S. and Singh, M.P. 2008. Plant Tissue Culture. APH Pub. New Delhi
7. Punia, M.S. 1998. Plant Biotechnology and Molecular Biology. Scientific Pub.

8. Bajaj YPS. (ed.). 1988. Biotechnology in Agriculture and Forestry. Springer Verlag.

Reference Distribution:

Module	Unit	Reference No.
1	1	
	2	
	3	
	4	
2	1	
	2	
	3	
3	1	
	2	
	3	
4	1	
	2	

Assessment Rubrics:

Evaluation Type – Theory	Marks
End Semester Evaluation	**50**

Continuous Evaluation		**25**
a)	Test Paper- 1	10
b)	Test Paper-2	10
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**75**

Evaluation Type – Practical		**Marks**
End Semester Evaluation		**15**
Continuous Evaluation		**10**
a)	Test Paper	4
b)	Practical Record and Submissions	4
c)	Viva-Voce	2
Total		**25**

Sample questions to Test Outcome

2 Mark Questions

11. Define forest genetics.
12. What is the significance of anthesis in tree breeding?
13. Name two important tree breeding methods used in forestry.
14. What is provenance testing in tree improvement?
15. Mention any two vegetative propagation methods used in forestry.

16. Define somatic embryogenesis in plant tissue culture.
17. What is the role of recombinant DNA technology in forestry?
18. List any two applications of genetic engineering in tree improvement.
19. What are synthetic seeds, and how are they used in forestry?
20. Name two conservation strategies used for preserving forest genetic resources.

6 Marks Questions

11. Explain the role of genetic, environmental, and phenotypic factors in determining tree growth and adaptability.
12. Compare and contrast various tree breeding methods, including selection, hybridization, and introduction.
13. Analyze the importance of population viability analysis (PVA) in conservation planning for forest species.
14. Evaluate the significance of plant tissue culture in forestry, focusing on its advantages and limitations.
15. Assess the impact of genetic engineering on forest conservation and the development of transgenic tree varieties.
16. Propose a tissue culture method for rapid clonal propagation of economically important tree species.
17. Develop a forest genetic conservation model incorporating in-situ and ex-situ methods.

14 Mark Questions

11. Analyze the impact of genetic, environmental, and phenotypic expressions on tree growth and adaptability. How do these factors influence forest productivity and conservation?
12. Evaluate various tree breeding methods such as selection, hybridization, and introduction. Discuss their advantages, limitations, and applications in forestry improvement.
13. Analyze the role of plant tissue culture in forestry. Discuss its importance, challenges, and future potential in large-scale tree propagation and conservation.
14. Evaluate the significance of genetic engineering in forestry. How has recombinant DNA technology contributed to forest management, and what are the ethical concerns associated with it?
15. Analyze the effectiveness of conservation strategies for forest genetic resources. Compare in-situ and ex-situ approaches, and discuss their role in ensuring sustainable forest biodiversity.

KU4VACFOR222 CIVIC EDUCATION

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	VAC	200-299	KU4VACFOR222	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: This course is designed to cultivate informed, responsible, and active citizenship among students. The course introduces learners to the foundational principles of democracy, the structure and functions of government, the Constitution of India, and the rights and duties of citizens. It explores the role of individuals and institutions in upholding democratic values, promoting social justice, and ensuring accountable governance. Through discussions, case studies, and community engagement, the course empowers students to critically examine societal issues and actively participate in civic life with integrity and purpose.

Course Prerequisite:

Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the core principles of democracy, citizenship, and governance.	***U***
2	Appreciate the values of social justice, equality, and diversity.	***A***
3	Engage in civic activities and public discourse responsibly.	***An***
4	Develop skills for critical thinking, participation, and ethical decision-making in civic life.	***C***

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔				
CO 2				✔			
CO 3		✔					✔
CO 4				✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: FOUNDATIONS OF CIVIC LIFE (5 HOURS)**	
	1	Meaning, scope, and importance of civic education
	2	Principles of democracy and responsible citizenship
	3	Civic values: tolerance, equality, justice, and integrity
2	**MODULE TITLE: CONSTITUTION, RIGHTS, AND GOVERNANCE (20 HOURS)**	
	1	Overview of the Indian Constitution
		c) Preamble
		d) Fundamental Rights and Duties

	2	Directive Principles of State Policy
	3	Structure and functions of the Government
		a) Legislature
		b) Executive
		c) Judiciary
	4	Electoral process and the role of the Election Commission
	5	Local self-governance and decentralization (Panchayati Raj)
3	**MODULE TITLE: LAW, JUSTICE, AND HUMAN RIGHTS (10 HOURS)**	
	1	Rule of law and access to justice
	2	Universal Declaration of Human Rights (UDHR) and national human rights bodies
	3	Writs
	4	Community service, volunteering, and youth civic action
4	**MODULE TITLE: MAJOR LEGAL PROVISIONS FOR PROTECTION OF WOMEN (10 HOURS)**	
	1	The Protection of Women from Domestic Violence Act, 2005
	2	The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013
	3	POCSO Act, 2012
	4	Role of National Commission for Women (NCW)
	5	State Commissions for Women
5	**Teacher Specific Module**	

	• *Case study analysis (e.g., Nirbhaya Case, Vishaka Case)* • *Legal literacy campaigns or poster presentations* • *Visit to Family Court / Women's Commission (if feasible)* • *Role play: Mock trial or counselling session*
	Space to fill the selected area/ activity

Essential Readings:

1. NCERT Textbooks (Civics – Class IX to XII)
2. The Constitution of India (Bare Act)
3. Jayapalan, N. – *Indian Political System*
4. UNDP – *Civic Education Toolkit*
5. Bhargava, R. – *Politics and Ethics of the Indian Constitution*

Suggested Readings:

1. Baxi, Upendra. The Future of Human Rights
2. Kaushik, Rajni. Democracy and Good Governance
3. Flavia Agnes. Law and Gender Inequality: The Politics of Women's Rights in India

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2

Total	**100**

Sample questions to Test Outcome

2 Marks Questions

1. Define civic education.
2. What do you mean by fundamental duties?
3. Mention any two Directive Principles of State Policy.
4. Name two constitutional rights available to Indian women.
5. What is meant by the rule of law?
6. Who is the current Chief Election Commissioner of India? *(Update during exam)*
7. Mention two functions of the National Human Rights Commission.
8. What is the purpose of the Preamble in the Indian Constitution?
9. Name any two civic responsibilities of a citizen.
10. What is the full form of NCW? What is its role?

6 Marks Questions

1. Explain the role of civic education in a democracy.
2. Discuss the importance of Fundamental Rights and Duties.
3. Briefly describe the structure of the Indian Parliament.
4. Write a short note on the role of youth in promoting civic responsibility.
5. Explain any three laws enacted for the protection of women in India.
6. Describe the powers and functions of the Election Commission of India.
7. How does media influence public opinion in a democracy?
8. Explain the significance of local self-governance in India.
9. Describe the role of NGOs in promoting human rights.
10. Distinguish between equality and equity with suitable examples.

14 Marks Questions

1. Describe the key features of the Indian Constitution and discuss its role in safeguarding democracy.
2. Critically evaluate the effectiveness of civic education in promoting active citizenship in India.
3. Discuss various laws available in India for the protection and empowerment of women.
4. Explain the structure and functions of the three organs of government with suitable examples.
5. Analyze the role of civil society and public participation in ensuring good governance.
6. Examine the major challenges to human rights in India and suggest measures to address them.
7. “Media is the fourth pillar of democracy.” Discuss the statement with examples.
8. Elaborate on the importance of ethical leadership and its impact on public life.
9. How does the Indian electoral system work? Evaluate its strengths and weaknesses.
10. Discuss the role of constitutional bodies in upholding democracy in India.

KU4VACFOR223 TOWARDS ENVIRONMENTAL STEWARDSHIP

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	VAC	200-299	KU4VACFOR223	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: This course aims to instil an ethic of environmental responsibility among students by exploring ecological principles, the human-environment relationship, contemporary environmental challenges, and sustainable practices. It emphasizes personal and collective action towards conservation, climate resilience, and ecological justice.

Course Prerequisite:

Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand key concepts of ecology and environmental science	***U***
2	Develop a stewardship mindset through sustainable practices and community action	***A***
3	Analyze human impact on ecosystems and the biosphere	***An***
4	Critically evaluate global and local environmental challenges	***E***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔				
CO 2				✔			
CO 3		✔					✔
CO 4				✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: FOUNDATIONS OF ENVIRONMENTAL UNDERSTANDING (5 HOURS)**	
	1	Definition and scope of environmental stewardship
	2	Principles of ecology and ecosystems
	3	Biodiversity: significance and threats
		Indigenous knowledge and environmental ethics
2	**MODULE TITLE: ENVIRONMENTAL ISSUES AND HUMAN IMPACT (10 HOURS)**	
	1	Pollution
		a) Types and Causes

		b) Mitigation Measures
	2	Climate change and global warming
	3	Deforestation, desertification, and habitat loss
	4	Urbanization and waste management
	5	Environmental disasters and their management
3	**MODULE TITLE: PATHWAYS TO SUSTAINABILITY (20 HOURS)**	
	1	Concept of sustainability
		a) Sustainability and development indicators
		b) Sustainable Development Goals
		c) Circular economy and green technologies
		d) Green Consumerism
	2	Renewable vs. non-renewable resources
	3	Certification of Sustainable Products
		a) Green Building: Indian Green Building Council (IGBC), LEED and GRIHA (Green Rating for Integrated Habitat Assessment) standards
		b) Forest Stewardship Council (FSC), Rainforest Alliance, Fairtrade International
		c) Ecomark (BIS Environmental Labelling Scheme)
	4	Requirements for sustainability: food security and agriculture
4	**MODULE TITLE: SUSTAINABLE LIFESTYLES AND CIVIC RESPONSIBILITY (10 HOURS)**	
	1	Carbon footprint: causes and reduction strategies

	2	Role of youth in sustainability movements
		a) Fridays for Future
		b) Sunrise Movement
		c) Climate Action Network
	3	Eco-leadership and environmental citizenship
	4	Community-based conservation and participatory governance
5	**Teacher Specific Module**	
	• *Campus audit for sustainability indicators* • *Debate* • *Visit to a certified green building (or virtual tour)* • *Prepare a personal sustainability plan* • *Designing a model eco-friendly home or classroom*	
	Space to fill the selected area/ activity	

Essential Readings:

1. Franco, I.B. and Tracey, J. (2019), "Community capacity-building for sustainable
2. development: Effectively striving towards achieving local community sustainability
3. targets", International Journal of Sustainability in Higher Education, Vol. 20 No. 4, pp.
4. 691-725
5. Our Common Journey: A Transition Toward Sustainability. National Academy Press,
6. Washington D.C. Soubbotina, T. P. 2004.
7. Elliott, Jennifer. 2012. An Introduction to Sustainable Development. 4th Ed. Routledge,
8. London.
9. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable
10. development." (2012).

11. Sachs, J. D. 2015. The Age of Sustainable Development. Columbia University Press,
12. New York.
13. Soubbotina, Tatyana P. 2004. Beyond Economic Growth: An Introduction to Sustainable Development. WBI learning resources series. Washington DC ; World Bank.
14. Kerr, Julie. Introduction to energy and climate: Developing a sustainable environment.
15. CRC Press, 2017.
16. Saito, Osamu. Sharing Ecosystem Services. Springer Singapore, 2020.
17. Nhamo, Godwell, and Vuyo Mjimba. Sustainable Development Goals and institutions of higher education. Springer, 2020.

Suggested Readings:

1. Carson, Rachel – *Silent Spring*
2. UNEP – *Global Environment Outlook Reports*
3. Erach Bharucha – *Textbook of Environmental Studies*
4. IPCC Reports – *Climate Change Assessment Reports*
5. Vandana Shiva – *Soil Not Oil*
6. Ministry of Environment, Forest and Climate Change (MoEFCC) – Acts & Notifications

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2 Marks Questions

1. Define sustainability in one sentence.
2. What is the full form of LEED?
3. Mention any two principles of sustainable development.
4. Name two eco-labels used in India for sustainable products.
5. What is a green building?
6. State one objective of the GRIHA rating system.
7. What does FSC certification stand for?
8. Mention any two features of a sustainable lifestyle.
9. What is the purpose of the Ecomark?
10. Name any two Sustainable Development Goals (SDGs) related to the environment

6 Marks Questions

11. Explain the role of the Forest Stewardship Council (FSC) in promoting sustainability.
12. Differentiate between LEED and GRIHA certification systems.
13. Write a short note on eco-friendly materials used in green buildings.
14. Discuss how the Indian Green Building Council (IGBC) contributes to sustainable construction.
15. List and briefly describe three global agencies that certify sustainable products.
16. How do smart cities incorporate sustainable infrastructure?
17. What are the main environmental benefits of green buildings?
18. Describe the concept of carbon footprint and suggest ways to reduce it.

14 Marks Questions

1. Discuss in detail the importance of sustainable practices in modern society and the role of certification agencies in ensuring sustainability.
2. Explain the concept of green buildings with examples. Highlight their features, benefits, and certification standards.
3. “Sustainable development requires civic engagement.” Justify the statement with reference to youth movements, lifestyle changes, and policy advocacy.
4. Compare and contrast major sustainability certification systems (LEED, GRIHA, FSC, Ecomark) and discuss their relevance in the Indian context.
5. Examine the role of infrastructure and urban planning in promoting sustainability. Use examples of smart cities or eco-villages.
6. Write an essay on the United Nations Sustainable Development Goals (SDGs), focusing on their environmental dimensions and challenges in implementation.

KU4VACFOR224 CITIZEN SCIENCE IN CONSERVATION

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	VAC	200-299	KU4VACFOR224	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: The boundaries between science and society are becoming increasingly porous in today's rapidly evolving world. Citizen science, a collaborative approach that involves nonprofessional individuals in scientific research, is gaining prominence as a powerful tool for addressing complex and pressing challenges. At the same time, scientists are increasingly expected to engage with their communities and consider their work's broader ethical, social, and political implications. This interdisciplinary course explores the intersection of citizen science and the ethical obligations of scientists as responsible and engaged citizens.

Course Prerequisite:

Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Describe how citizen science contributes to biodiversity and conservation efforts.	***R***
2	Use citizen science platforms (e.g., iNaturalist, eBird) to gather biodiversity data and understand and apply basic methods for data validation and quality control.	***A***

3	Evaluate the strengths and limitations of citizen science in various ecological and social contexts.	***E***
4	Develop a basic citizen science project plan focused on a conservation issue.	***C***

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔				
CO 2	✔			✔			
CO 3	✔		✔	✔			✔
CO 4	✔	✔				✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: Introduction to Citizen Science and Conservation (20 Hours)**	
	1	Citizen Science
		d) Definition and history of citizen science

		e) Scope of citizen Science
		f) Types of citizen science (contributory, collaborative, co-created)
	2	Definition and scope of conservation biology
	3	Principles of conservation biology
		Biodiversity patterns and values
		Threats to biodiversity
		Conservation strategies
2	**MODULE TITLE: Citizen Science in Conservation(10 Hours)**	
	1	The role of citizen science in conservation
	2	Case studies of successful citizen science projects a) Biodiversity monitoring b) Environmental monitoring c) Community-based monitoring
	3	Applications of citizen science in biodiversity and mapping
3	**MODULE TITLE: Practical Applications of Citizen Science(10 Hours)**	
	1	Data collection and analysis
	2	Project design and implementation
	3	Communication and engagement
	4	Technology and tools
4	**MODULE TITLE: Tools and Platforms(5 Hours)**	
	1	Mobile apps
	2	Web platforms

	3	Sensors and Devices
5	**Teacher Specific Module (30 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	Space to fill the selected area/ activity	

Essential Readings:

- Christopher A Lepczyk. 2020. Handbook of Citizen Science in Ecology and Conservation
- Hunter L Malcom. 1996. Conservation Biology. Blackwell Science. Chicago
- Kumar and Asija. Biodiversity – Principles and conservation. UpdeshPurohit, Agrobios, Jodhpur
- Negi, S.S. 1993. Biodiversity and its Conservation in India. India Publishing company, New
- Caren Cooper., 2016. Citizen Science: How Ordinary People are Changing the Face of Discovery.
- Darlene Cavalier. 2020. The Field Guide to Citizen Science: How You can Contribute to Scientific Research and Make a Difference.
- Loree Griffin Burns. 2012. Citizen Scientists: Be a Part of Scientific Discovery from Your Own Backyard.
- Mary Ellen Hannibal. 2016. Citizen Scientist: Searching for Heroes and Hope in an Age of Extinction
- Simon Worthington. 2021. Citizen Science Skilling for Library Staff, Researchers and the Public
- Kristin Frontichiaro. 2017. Citizen Science
- Alan Irwin. 1995. Citizen Science: A Study of People, Expertise and Sustainable Development.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	1,2
	3	3
2	1	5,6
	2	7
	3	8
3	1	6
	2	6
	3	6
4	1	
	2	

Suggested Readings:

- Chandra K Clarke. 2014. Be the Change: Saving the World with Citizen Science.
- Anna Forrester. 2016. Bat Count: A Citizen Science Story.
- Heidi E Y Stemple. 2018. Counting Birds: The Idea That Helped Save Our Feathered Friends.
- Susan Edwards Richmond. 2019. Bird Count.
- Akiko Busch., 2013. The Incidental Steward: Reflections on Citizen Science.
- Kathryn Hulick. 2019. Citizen Science: How Anyone can Contribute to Discovery.

- Grey Landgraf. 2013. Citizen Science for Families: Taking Part in Real Science.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2 Mark Questions

1. Which biodiversity data collection tool is app-based and uses photographs for species identification?
2. List two benefits of citizen science for conservation researchers.
3. Summarize the main threats to global biodiversity identified by conservation biologists.
4. Discuss how invasive species can disrupt native ecosystems and lead to biodiversity loss.
5. Why is communication important between scientists and citizen participants?
6. Describe the role of local communities in citizen science
7. Summarize the challenges faced by citizen science in conservation.
8. Give an example of a successful citizen science project and describe its conservation impact.
9. Discuss the importance of data validation in citizen science projects.
10. How can citizen science help in managing invasive species or tracking endangered species?
11. Explain how citizen science helps in conserving biodiversity.

6 Mark Questions

1. Compare and contrast traditional scientific research with citizen science in conservation.
2. Distinguish between in-situ and ex-situ citizen science approaches.
3. Identify strengths and weaknesses of citizen-collected data.
4. Design a basic citizen science project to document urban wildlife.
5. Identify strengths and weaknesses of citizen-collected data.
6. Imagine you are organizing a local citizen science project to monitor bird species in your area. What steps would you take to ensure reliable data collection?
7. Propose a campaign to increase youth involvement in conservation through citizen science.

14 Mark Questions

1. Compare and contrast the roles of professional scientists and citizen scientists in conservation research.
2. Analyze the potential risks and benefits of relying on citizen-collected data in scientific studies.
3. Do you think citizen science is a reliable method for gathering conservation data? Support your answer with examples.
4. Evaluate the impact of citizen science on public awareness and policy-making in conservation.
5. Design a new citizen science initiative to track invasive plant species in your region. What tools, methods, and community engagement strategies would you use?

KU4VACFOR225 BIOETHICS AND IPR

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	VAC	200-299	KU4VACFOR225	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: This course introduces students to the ethical, legal, and social implications of advances in the biological sciences. It explores fundamental issues in bioethics, such as genetic engineering, cloning, and stem cell research, while equipping students with a foundational understanding of intellectual property rights (IPR) as they pertain to biotechnology, biodiversity, and innovation. Through case studies, discussions, and legal frameworks, the course aims to prepare responsible scientists, researchers, and citizens.

Course Prerequisite:

Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	To understand the ethical dimensions of biotechnological research and applications	***U***
2	To promote awareness of the importance of responsible innovation and fair access to biological resources	***A***
3	To analyze contemporary bioethical issues including those involving human, animal, and environmental welfare	***An***

4	Identify complex situations that frequently present legal issues to the stakeholders of intellectual property rights	***E***

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔				
CO 2				✔			
CO 3		✔					✔
CO 4				✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: INTRODUCTION TO BIOETHICS (5 HOURS)**	
	1	Definition, scope, and importance of bioethics
	2	Ethical theories and principles
		a) autonomy
		b) beneficence
		c) non-maleficence
		d) justice

	3	Human dignity and rights
	4	Animal ethics and welfare
2	**MODULE TITLE: CODES AND GUIDELINES (10 HOURS)**	
	1	Principles of Bioethics and Application
		a) Belmont Report
		b) Nuremberg code
	2	CIOMS guidelines
	3	Indian codes of ethics
		a) ICMR Ethical Guidelines
		b) General and Specific Principles
		c) Indian Medical Council Act
		d) Schedule Y
		e) Indian Good Clinical Practice Guidelines
	4	Clinical Trial Registry of India
	5	Ranjith Roy Choudhry report
3	**MODULE TITLE: INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (15 HOURS)**	
	1	Introduction to IPR
		a) Meaning of property; Origin & Nature
		b) Meaning of Intellectual Property Rights
	2	Kinds of Intellectual property rights
		a) Copy Right, Patent, Trade Mark

		b) Trade Secret and trade dress
		c) Design & Layout Design
		d) Geographical Indication
		e) Plant Varieties and Traditional Knowledge
	3	Patent Rights
		a) Indian Patent Act
		b) Criteria for patentability: novelty, utility, and non-obviousness
		c) Registration Procedure and Documentation
	4	Copy Rights
		a) Definition &Types of Copy Right,
		b) Registration Procedure and Documentation
		c) Piracy & Infringement
4	**MODULE TITLE: IPR AND BIODIVERSITY (15 HOURS)**	
	1	International treaties and conventions:
		a) TRIPS (WTO)
		b) Convention on Biological Diversity (CBD)
		c) International Union for the Protection of New Varieties of Plants
		d) Nagoya Protocol on Access and Benefit Sharing
	2	Indian laws and policies:
		d) Protection of Plant Varieties and Farmers' Rights Act (PPV&FR)
		e) Biological Diversity Act (2002)
	3	Traditional knowledge and IPR

	4	Bio piracy
5	**Teacher Specific Module**	
	• *Patent review of a biotech product* • *Ethical analysis of a gene-editing technology* • *Case study on biopiracy involving Indian traditional knowledge* • *Analysis of IPR protection in local plant varieties* • *GI products of Kerala*	
	Space to fill the selected area/ activity	

Essential Readings:

1. ALEXANDRA GEORGE-CONSTRUCTING INTELLECTUAL PROEPRTY(CUP2012)
2. UN SUBCOMMISSION ON THE PROMOTION AND PROTECTIONOF HUMAN RIGHTS RESOLUTION 200/7 INTELLECTUAL PROPERTY AND HUMAN RIGHTS UN DOC.e/CN.4. SUB 2/RES/2000/7; 17TH AUGUST 2000.
3. Prabuddha Ganguli, (2001): Intellectual Property Rights. Tata McGraw Hill.
4. W.R. Cornish, (2013): Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights. Sweet and Max Well London
5. Blakeney, (1996), Trade Related Aspects of Intellectual Property Rights: A Concise
6. Guide to the TRIPS Agreement. Sweet and Max Well London
7. Beauchamp TL, Childress JF [2011]. Principles of Biomedical Ethics. Edition 5. Oxford
8. University Press, New York.
9. Timms O [2016]. Biomedical Ethics. Edition 1. Elsevier
10. Ethical Guidelines for Biomedical Research on Human Research, ICMR, 2006
11. International Ethical Guidelines for Biomedical Research Involving Human Subjects,
12. CIOMS, 2002
13. United States. (1978). The Belmont report: Ethical principles and guidelines for the
14. protection of human subjects of research. Bethesda, Md.: The Commission.
15. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310[20]:2191-4.
16. The Nuremberg Code (1947) In: Mitscherlich A, Mielke F. Doctors of infamy: the story of the Nazi medical crimes. New York: Schuman, 1949

17. Drug and Cosmetic rules, Schedule Y, 2005
18. [http://cdsco.nic.in/html/D&C_Rules_Schedule_Y.pdf]
19. Indian Good Clinical Practice Guidelines [http://www.cdsco.nic.in/html/GCP1.html}
20. Report of the Prof. Ranjit Roy Chaudhury Expert Committee. 2013
21. [http://www.cdsco.nic.in/writereaddata/Report_of_Dr_Ranjit_Roy.pdf]

Suggested Readings:

1. Beauchamp & Childress – *Principles of Biomedical Ethics*
2. Krishna Veni – *Bioethics and Biosafety*
3. Subbaram N.R. – *Intellectual Property Rights*
4. B. D. Singh – *Biotechnology: Expanding Horizons*
5. S.B. Rao – *Bioethics and Biosafety*

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2 Marks Questions

1. Define bioethics.
2. What is the principle of autonomy in bioethics?
3. Name any two ethical issues related to genetic engineering.
4. What is a patent?
5. Mention any one international treaty related to biodiversity.

6. Define biopiracy.
7. What are the 3Rs in animal research ethics?
8. State one function of the World Intellectual Property Organization (WIPO).
9. What is the Biological Diversity Act (2002) in India?
10. What does TRIPS stand for?

6 Marks Questions

1. Explain the difference between animal rights and animal welfare.
2. Discuss the ethical concerns related to cloning.
3. Describe the patentability criteria for biotechnological inventions.
4. What are the key objectives of the Convention on Biological Diversity (CBD)?
5. Explain the role of ethics committees in biomedical research.
6. Briefly describe the Nagoya Protocol and its significance.
7. Discuss the ethical implications of gene editing technologies like CRISPR-Cas9.
8. Write a short note on traditional knowledge and IPR.

14 Marks Questions

1. Discuss the principles of bioethics and their application in contemporary biomedical research.
2. Examine the role of intellectual property rights in promoting innovation and protecting biodiversity.
3. Analyze the ethical and legal challenges posed by cloning and stem cell research.
4. Discuss the importance of international treaties like TRIPS and CBD in regulating biotechnology and biodiversity conservation.
5. Explain the concept of biopiracy with relevant examples, and suggest measures to prevent it.
6. Evaluate the impact of patent laws on farmers' rights and access to genetic resources in India.
7. Write an essay on the ethical considerations and legal frameworks governing the use of animals in research.

KU4SECFOR230 DENDROLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	SEC	200-299	KU4SECFOR230	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: This course provides an introduction to the study of trees and the basic principles of plant classification and nomenclature. Students will learn about different systems of plant classification including artificial, natural, and phylogenetic systems, with a focus on the Bentham and Hooker classification. The course also covers the objectives and principles of plant nomenclature under the International Code of Botanical Nomenclature (ICBN). Practical skills such as the use of identification keys, preparation of herbaria, and the role of vegetative morphology in tree identification will be developed. Major angiosperm families important in forestry, and ecology will be studied, including their diagnostic features, floral formula, and economic significance.

Course Prerequisite

- Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Explain the definition, scope, and importance of dendrology and State the principles and objectives of plant nomenclature (ICBN).	***U***

2	Use identification keys (indented and bracketed) to identify tree species, Prepare and maintain a herbarium specimen correctly, Identify trees using vegetative morphological characters such as bole, bark, leaves, and exudations.	***A***
3	Differentiate between artificial, natural, and phylogenetic classification systems, Analyze the diagnostic features and systematic positions of major angiosperm families, Interpret floral formulas and their significance in plant identification.	***An***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create ©***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔	✔		✔			
CO 2							
CO 3	✔	✔			✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**
1	**MODULE TITLE: FUNDAMENTALS OF DENDROLOGY AND PLANT CLASSIFICATION (10 HOURS)**	
	1	Definition, scope, and importance of Dendrology
		d) Artificial classification
		e) Natural classification
		f) Phylogenetic classification

	2	Bentham and Hooker classification system
2	**MODULE TITLE: NOMENCLATURE AND IDENTIFICATION TECHNIQUES (15 HOURS)**	
	1	Plant nomenclature: Objectives and principles of ICBN (International Code of Botanical Nomenclature)
	2	Identification keys
		e) Indented keys
		f) Bracketed keys
	3	Herbaria: Preparation, labelling, and significance
3	**MODULE TITLE: VEGETATIVE MORPHOLOGY IN TREE IDENTIFICATION (10 HOURS)**	
	1	Role of vegetative characters in identification
		a) Bark
		b) Blaze
		c) Exudations
		d) Leaves
		e) Glands
4	**MODULE TITLE: SYSTEMATICS OF MAJOR ANGIOSPERM FAMILIES (10 HOURS)**	
	1	Systematic position, diagnostic features, floral formula, economic importance, and key members of the following families
		a) Annonaceae
		b) Dipterocarpaceae

		c) Tiliaceae
		d) Meliaceae
		e) Rutaceae
		f) Anacardiaceae
		g) Myrtaceae
		h) Leguminosae (Fabaceae, Caesalpiniaceae, Mimosaceae)
		i) Rhizophoraceae
		j) Apocynaceae
		k) Bignoniaceae
		l) Verbenaceae
		m) Casuarinaceae
5	**Teacher Specific Module (5 Hours)**	
	Directions: This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is strictly internal.	
	5.17 Field visit to study the morphological characteristics and develop indented and bracketed keys for a selected group of plants 5.18 Identify and record vegetative characters (bole, bark, blaze, leaves, exudates, glands) of 5–10 trees 5.19 Collection, pressing, drying, mounting, and labelling of at least 5 plant specimens 5.20 Preparation of Keys for the trees of campus/botanical garden 5.21 Invited lecture from a taxonomist fill the selected area/ activity	

Essential Readings:

1. Sambamurthy, A. V. S. S. 2005. Taxonomy of Angiosperms. I.K International Pvt. Ltd. 892 p.

2. Jeffrey, C. 1982. An Introduction to plant taxonomy. Allied publishers. 154p
3. Henry, A. N. and Chandrabose, M. 1980. An Aid to the International Code of Botanical Nomenclature. Today and Tomorrow printers and publishers. 100p.
4. Johri, R. M and SnehLata. 2005. Taxonomy- 1 (Systematics and Morphology). SonaliPublications. 340 p
5. Johri, R. M and SnehLata. 2005. Taxonomy- 2 (Polypetalae). Sonali Publications. 300 p
6. Johri, R. M and SnehLata. 2005. Taxonomy- 3 (Gamopetalae). Sonali Publications. 190p

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	2
2	1	3
	2	3
	3	3
3	1	4
4	1	5,6

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3

d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2 Mark Questions

1. Define dendrology and explain its scope in plant science.
2. State the main objectives of the International Code of Botanical Nomenclature (ICBN).
3. List the major vegetative characters used in tree identification.
4. Explain the structure and purpose of indented and bracketed keys.
5. Describe the process of herbarium specimen preparation.

6 Mark Questions

1. Compare artificial, natural, and phylogenetic systems of classification with suitable examples.
2. Differentiate between indented and bracketed keys in terms of structure and application.
3. Compare the vegetative and floral features of the families Annonaceae and Apocynaceae.

14 Mark Questions

1. Analyze the diagnostic features of the family Fabaceae and explain how they aid in its identification.
2. Interpret the floral formula of a member of the Rutaceae family and relate it to its floral structure.
3. Examine the vegetative characters (bole, bark, exudate, leaves) of two local trees and discuss their significance in field identification.

KU4SECFOR231 ORNITHOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	SEC	200-299	KU4SECFOR231	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: This course explores the biology, ecology, and conservation of birds, covering anatomy, physiology, behaviour, taxonomy, and their roles in ecosystems. Fieldwork includes bird identification, survey techniques, and habitat assessment.

Course Prerequisite:

- Basic knowledge of Ecology
- Ability to conduct fieldwork

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Describe avian anatomy, physiology, and adaptations.	U
2	Analyze bird behavior and communication strategies.	An
3	Apply field techniques for bird identification and surveys.	A
4	Evaluate conservation challenges and strategies for avian species.	E

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔	✔		✔			✔
CO 2	✔	✔		✔		✔	✔
CO 3	✔	✔	✔	✔	✔		✔
CO 4	✔	✔	✔	✔	✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
	MODULE 1: AVIAN BIOLOGY & ADAPTATIONS (5 HOURS)	
	1	Ornithology
		a) Characteristics and adaptations of birds
		b) Renowned ornithologists and their contribution
	2	Feathers & Flight Mechanics
		a) Types of feathers
		b) Molting
		c) Types of flights
2	**BIRD IDENTIFICATION TECHNIQUES (10 Hours)**	
	1	Bird identification features

		a) Visual Identification
		b) Auditory identification
	2	Techniques for bird watching
		a) Principles of Bird Watching
		b) Bird Watching Equipment and Tools
		c) Techniques for Effective Bird Watching
3	**MODULE 3: TAXONOMY OF BIRDS (15 HOURS)**	
	1	Bird Classification
		a) Major orders and families
	2	Survey Methods
		a) Point counts
		b) transects
		c) banding techniques
4	**MODULE 4: CONSERVATION & HUMAN IMPACTS (10 HOURS)**	
	1	Threats to Birds
		1. Habitat loss
		a) climate change
		b) pollution
	2	Conservation Strategies
		a) Protected areas
		b) captive breeding
		c) citizen science (e.g., eBird)

	3	Birds in Culture & Economy
5	**Teacher Specific Module (5 Hours)**	

Essential Readings:

1. Williams, T.D., 2012. *Physiological adaptations for breeding in birds*. Princeton University Press.
2. Birkhead, T.R. and Charmantier, I., 2009. History of ornithology. *eLS*.
3. Bostwick, K., 2016. Feathers and plumages. *Handbook of Bird Biology.–3rd ed.–Wiley*, pp.101-148.
4. Henderson, C.L., 2008. *Birds in flight: the art and science of how birds fly*. Voyageur Press.
5. Praveen, J., Jayapal, R. and Pittie, A., 2020. Taxonomic updates to the checklists of birds of India, and the South Asian region—2020. *Indian Birds*, *16*(1), pp.12-19.
6. Buff, S., 2010. *Birding for Beginners: A Comprehensive Introduction to the Art of Birdwatching*. Rowman & Littlefield.
7. Wetmore, A., 1960. A classification for the birds of the world. *Smithsonian Miscellaneous Collections*.
8. Gregory, R.D., Gibbons, D.W. and Donald, P.F., 2004. Bird census and survey techniques. *Bird ecology and conservation*, pp.17-56.
9. Lees, A.C., Haskell, L., Allinson, T., Bezeng, S.B., Burfield, I.J., Renjifo, L.M., Rosenberg, K.V., Viswanathan, A. and Butchart, S.H., 2022. State of the world's birds. *Annual Review of Environment and Resources*, *47*(1), pp.231-260.
10. Hundal, S.S., 2004, March. Wildlife conservation strategies and management in India: an overview. In *Proceedings of the species at risk 2004 pathways to recovery conference, Victoria conference centre, BC, Canada* (pp. 2-6).

11. Khadher, R. and Aiyadurai, A., Human-bird Relations: Religious and Cultural Significance in India.

Reference Distribution:

Module	Unit	Reference No.
1	1	1,2
	2	3,4
2	1	5
	2	6
3	1	7
	2	8
4	1	9
	2	10
	3	11

Suggested Readings:

1. Morrison, M.L., Rodewald, A.D., Voelker, G., Colón, M.R. and Prather, J.F. eds., 2018. *Ornithology: foundation, analysis, and application*. JHU Press.
2. Mainwaring, M.C., 2017. Why birds matter: avian ecological function and ecosystem services. *The Condor: Ornithological Applications*, *119*(2), pp.354-355.
3. Dunne, P., 2012. *The Art of Bird Identification: A Straightforward Approach to Putting a Name to the Bird*. Stackpole Books.
4. Dunne, P., 2003. *Pete Dunne on bird watching: The how-to, where-to, and when-to of birding*. Houghton Mifflin Harcourt.
5. Fuller, R.J. ed., 2012. *Birds and habitat: relationships in changing landscapes*. Cambridge University Press.
6. Wallace GJ and HD Mahan. 20015. An introduction to ornithology. Mc Million Publishing Company, New York.
7. Collias, N.E. and Collias, E.C., 2014. *Nest building and bird behavior* (Vol.857). Princeton University Press.

8. Newton, I., 2023. *The migration ecology of birds*. Elsevier.
9. Ali, S., 1979. Bird study in India: its history and its importance. *India International Centre Quarterly*, *6*(2), pp.127-139.
10. Shyamal, L., 2007. Opinion: Taking indian ornithology into the information age. *Indian Birds*, *3*(4), pp.122-137.
11. Chandler, M., See, L., Copas, K., Bonde, A.M., López, B.C., Danielsen, F., Legind, J.K., Masinde, S., Miller-Rushing, A.J., Newman, G. and Rosemartin, A., 2017. Contribution of citizen science towards international biodiversity monitoring. *Biological conservation*, *213*, pp.280-294.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2 Mark Questions

5. List any two key characteristics that distinguish birds from mammals.
6. What are flight feathers? Mention their types.
7. Explain the role of feathers in bird thermoregulation.
8. Name two renowned ornithologists and their contributions.
9. What is molting in birds?
10. List any two purposes of bird calls.
11. Differentiate between song and call in birds
12. Name any two bird behaviors observed during courtship.
13. What is mimicry in birds? Name a bird known for this behavior.

14. Mention two ways birds use visual signals for communication.

6 Mark Questions

6. Describe how you would conduct a birdwatching field trip in a forested area. What key preparations and tools would you use?
7. Explain the steps involved in identifying a bird using both visual and auditory features during a survey.
8. Design a simple checklist for bird observation during a transect walk.
9. Analyze how environmental factors like light and noise pollution can affect bird communication.
10. Interpret the courtship and territorial behaviors in birds and explain how they relate to species survival.
11. Examine flocking behavior in birds and explain the possible ecological benefits.
12. Analyze bird migration patterns and discuss the role of navigation cues such as the sun, stars, and magnetic fields.

14 Mark Questions

4. Design a bird conservation plan for your local area or campus. Include survey methods, community engagement, and monitoring tools.
5. Create a proposal for a public awareness campaign on bird conservation using social media, education, and citizen science.
6. Develop a conservation strategy that integrates indigenous knowledge systems with modern ecological approaches to protect a specific bird species.
7. Create a model for an eco-tourism initiative centered around birdwatching that balances conservation and livelihood goals.

KU4SECFOR232 HERPETOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	SEC	200-299	KU4SECFOR232	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: This course provides an in-depth study of amphibians and reptiles, collectively known as herpetofauna. Students will explore the taxonomy, anatomy, physiology, behavior, ecology, evolution, and conservation of these ectothermic vertebrates. Through lectures, discussions, and (if applicable) hands-on laboratory or fieldwork, students will develop skills in species identification, ecological monitoring, and data analysis. Emphasis is placed on understanding the ecological roles of herpetofauna, their adaptations to diverse environments, and current challenges they face due to habitat loss, climate change, and disease. The course also covers global and regional diversity, with examples from local ecosystems where possible.

Course Prerequisite:

Ability to write examinations in English.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Identify major groups of amphibians and reptiles and describe their evolutionary relationships	***R***
2	Analyze herpetological data and interpret ecological patterns	***An***
3	Evaluate the significance of herpetofauna in ecosystems and conservation biology.	***E***
4	Create knowledge and conduct basic field or laboratory techniques used in herpetological research.	***C***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔						
CO 2	✔	✔					
CO 3		✔	✔		✔		
CO 4			✔	✔	✔	✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE 1: INTRODUCTION TO HERPETOLOGY (10 HOURS)**	
	1	Evolution of Reptiles and Amphibians
	2	Systematics and biogeography of herpetofauna
	3	Major Reptiles and Amphibians of India with reference to Western ghats
	4	Characteristic features of Reptile and Amphibians
2	**MODULE 2: REPRODUCTION AND BEHAVIOUR OF HEPETOFAUNA (15 Hours)**	
	1	Reproduction in Herpetofauna
		a) Breeding biology of Reptiles and Amphibia
		b) Role of temperature in sex determination of Reptiles

	2	Behaviour of Herpetofauna
		a) Reproductive behaviour
		b) Defensive mechanism
		c) Thermoregulation
		d) Adaptative mechanism
3	**MODULE 3: SNAKES OF INDIA (5 HOURS)**	
	1	Identification of venomous and non- venomous snakes in India
	2	Snake bite
		a) Venom
		b) Anti venom
		c) First aid and management of snake bite cases
4	**MODULE 4: CONSERVATION BIOLOGY OF HERPETOFAUNA (15 HOURS)**	
	1	Endemism
		a) Rarity and extinction of species of herpetofauna
		b) Threats and causes of extinction
	2	Conservation and management of Indian herpetofauna
		a) Major Ex-situ conservation in India
		b) Captive breeding of herpetofauna
	3	Population surveys and census techniques for herpetofauna
	4	Conservation problems and challenges of herpetofauna in Indian subcontinent
5	**Teacher Specific Module (5 Hours)**	

	Directions: Describe the ecological roles and importance of herpetofauna. Practice the ethical field observation and data collection method. Discuss threats to reptiles and amphibians including habitat destruction and climate change

Essential Readings

1. Zug, G. R., Vitt, L. J., & Caldwell, J. P. (2001).
   Herpetology: An Introductory Biology of Amphibians and Reptiles (2nd or 3rd Ed.).
2. Pough, F. H., Andrews, R. M., Cadle, J. E., Crump, M. L., Savitzky, A. H., & Wells, K. D. (2015).
   Herpetology (4th Ed.).
3. Whitaker, R., & Captain, A. (2004).
   Snakes of India: The Field Guide.
4. Daniel, J. C. (2002).
   The Book of Indian Reptiles and Amphibians.
   Bombay Natural History Society (BNHS).
5. Dinesh, K. P., Radhakrishnan, C., et al. (2013).
   Amphibians of India: Updated Checklist and Distribution.
6. IUCN SSC Amphibian and Reptile Specialist Group Publication Species status reports, Red List assessments, and habitat conservation guidelines.
7. Heatwole, H., & Wilkinson, J. W. (2009).
   Amphibian Biology (multi-volume series).
8. Murthy, T. S. N. (1990).
   A Field Guide to the Amphibians and Reptiles of the Western Ghats.
   Zoological Survey of India (ZSI).
9. Dash, M. C., & Mahanta, L. (1993).
   Ecology, Distribution and Conservation of Amphibians and Reptiles in India.
   Environment and Ecology.

Reference Distribution:

Module	Unit	Reference No.
1	1	1
	2	5
	3	8
	4	1,2,4

2	1	1,2
	2	2
3	1	3
	2	3
4	1	6
	2	9
	3	6
	4	9

Suggested Readings:

- Herpetology – *Laurie J. Vitt & Janalee P. Caldwell*
- Biology of Amphibians – *William E. Duellman & Linda Trueb*
- Reptile Ecology and Conservation – *Edited by C. Kenneth Dodd Jr.*
- Amphibians of Peninsular India – *R. Biju et al.*
- Snakes of India: The Field Guide – *Romulus Whitaker & Ashok Captain*
- A Photographic Guide to Snakes and Other Reptiles of India – *Indraneil Das*

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15

c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2 Mark Questions

1. Define ectothermy and explain how it affects reptilian behavior.
2. What are the major distinguishing features between amphibians and reptiles?
3. List any three families of Indian amphibians and give one example species from each.
4. Describe the structure and function of amphibian skin.
5. What is tail autotomy? Which groups of reptiles use this defense mechanism

6 Mark Questions

1. Describe the role of herpetofauna in forest ecosystems and their significance in ecological balance.
2. Explain the reproductive strategies of frogs and compare them with those of snakes
3. Analyze the impacts of deforestation and forest fragmentation on herpetofaunal diversity.
4. Explain how temperature-dependent sex determination works in reptiles, with examples.
5. Differentiate venomous and non- venomous snakes of India with examples

14 Mark Questions

1. Describe the major taxonomic groups of reptiles and amphibians found in India. Highlight distinguishing characteristics and give two examples from each group.
2. Explain the physiological and ecological adaptations of amphibians and reptiles that enable them to survive in forest ecosystems. Illustrate with examples from Indian species.
3. Design a year-long community-based conservation program for the protection of amphibians and reptiles in a forest area facing biodiversity loss. Include objectives, methods, stakeholder involvement, and evaluation tools.

KU4SECFOR233 FOREST BIOMETRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	SEC	200-299	KU4SECFOR233	3	45

Learning Approach (Hours/ Week)			Marks Distribution- Theory			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0		35	65	100	1.5

Course Description: Forest Biometry involves the application of statistical and mathematical principles to the measurement and analysis of forest resources. This course enables students to understand, measure, analyse, and model forest stand parameters such as tree diameter, height, volume, and biomass. It also covers growth and yield modelling and the use of statistical tools in forest inventory and data interpretation.

Course Prerequisite:

Ability to write examinations in English.

Course Outcomes:

CO No	Expected Outcome	Learning Domains
1	To understand the concepts and importance of forest measurement	***U***
2	To make forest inventory reports that support specific multiple land management objectives	***A***
3	To analyse forest inventory data to project future stand conditions	***An***
4	Develop skills in the measurement of tree and stand attributes	***C***

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔		✔				
CO 2				✔			
CO 3		✔					✔
CO 4				✔		✔	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION
1	**MODULE TITLE: INTRODUCTION TO FOREST BIOMETRY (15 HOURS)**	
	1	Definition, scope, and importance of forest biometry
	2	Measurement of tree dimensions
		e) diameter
		f) height
		g) Tree form; Metgerz's Theory
		h) bark thickness
	3	Instruments used
		a) calipers

		b) diameter tape
		c) clinometer
		d) relascope
		e) hypsometer
	4	Measurement errors and precision
		a) sources and types of errors
		b) Concepts of accuracy
2	**MODULE TITLE: DETERMINATION OF TREE PARAMETERS (10 HOURS)**	
	1	Measurement of Volume of Trees
		a) Quarter girth formula
		b) Volume Table
	2	Solid volume of firewood
		a) Xylometric method
		b) Specific gravity method
		c) Measurement of Branch wood
		d) Biomass Estimation
	3	Dendrochronology
	4	Age determination
		a) Stem analysis
		b) Stump analysis
		c) Increment boring

3	**MODULE TITLE: EVALUATION OF SITE QUALITY (10 HOURS)**	
	1	Site Quality
		e) Site quality determination by evaluation of site factors
		f) Site quality determination by evaluation of vegetative factors
		g) Site quality determination by evaluation of site factors
		h) Evaluation of site quality by using tree characteristics:
	2	Fractional quality
	3	Importance of site quality
	4	Determination of site index
4	**MODULE TITLE: FOREST INVENTORY (10 HOURS)**	
	1	Forest Inventory; Definition and Scope
	2	Forest Enumeration
		f) Total or complete enumeration
		g) Partial enumeration
		h) Factors deciding the choice of kind enumeration
	3	Sampling
		a) advantages of sampling
		b) kinds of sampling
		c) Sampling units
		d) Laying out of sampling plot
		e) Sampling intensity

	4	Point sampling
		a) Horizontal point sampling; concept and instruments used
		b) Vertical point sampling; concept and instruments used
5	**Teacher Specific Module**	
	• *Calculations of volume of felled as well as standing trees;* • *Volume table preparation;* • *Application of different sampling methods;* • *Preparation of yield and stand table;* • *Quantification of regeneration and stand establishment;* • *Measurement of crown density and crown ratios;* • *Crown profiling of trees and stand;* • *Dendrochronological studies.*	
	Space to fill the selected area/ activity	

Essential Readings:

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

Suggested Readings:

1. Husch, B., Beers, T.W., & Kershaw, J.A. – *Forest Mensuration*
2. Philip, M.S. – *Measuring Trees and Forests*
3. Avery, T.E., & Burkhart, H.E. – *Forest Measurements*
4. Gregoire, T.G., & Valentine, H.T. – *Sampling Strategies for Natural Resources and the Environment*
5. FAO Manuals on Forest Inventory and Biomass Estimation

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Continuous Evaluation		**35**
a)	Test Paper- 1	15
b)	Test Paper-2	15
c)	Assignment/ Seminar/ Book/ Article Review/ Field Report	3
d)	Viva-Voce	2
Total		**100**

Sample questions to Test Outcome

2 Marks Questions

1. Define forest biometry.
2. What is the difference between precision and accuracy?
3. Name two instruments used for measuring tree height.
4. Define form factor.
5. What is a volume table?
6. Explain the term “sampling intensity.”
7. What is mean annual increment (MAI)?
8. Mention any two types of sampling methods used in forest inventory.
9. Write the formula for calculating the volume of a cylinder.
10. What is a site index?

6 Marks Questions

1. Explain the sources and types of errors in forest measurements.
2. Describe the construction and use of local volume tables.
3. Differentiate between systematic and stratified sampling with examples.
4. Write a short note on destructive and non-destructive biomass estimation methods.
5. Explain current annual increment (CAI) and its significance in forest management.

6. Discuss the Bitterlich method of angle count sampling.
7. Describe the various types of plots used in forest inventory.
8. What are the differences between empirical and process-based growth models?

14 Marks Questions

1. Explain the different methods used for measuring tree volume. Discuss the advantages and limitations of each.
2. Describe in detail the process of conducting a forest inventory using systematic sampling.
3. Elaborate on the various growth and yield models used in forestry. How are these models used for forest management planning?
4. Explain the role of forest biometry in sustainable forest resource management. Include tools, methods, and data interpretation techniques.
5. Discuss in detail the procedure and importance of biomass estimation in forest ecosystems. Include examples of allometric equations.
6. Write an essay on forest measurement errors. How can these be minimized or corrected during field surveys?