



**ROYAL SCHOOL OF LIFE SCIENCES (RSLSC)**

**COURSE STRUCTURE & SYLLABUS**

**FOR**

**M.Sc. IN FORESTRY**

**W.E.F**

**AY – 2024-25**

<b>M.SC. FORESTRY</b>							
<b>1<sup>ST</sup> SEMESTER</b>							
<b>Sl. No.</b>	<b>Subject Code</b>	<b>Names of Papers</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCP</b>
<b>Core paper</b>							
1	C101	Forrest ecology and Biodiversity Conservation	4	0	0	4	4
2	C102	Forest resources & economics	4	0	0	4	4
3	C103	Forestry Biometry	4	0	0	4	4
4	C104	Principles of Silviculture	4	0	0	4	4
5	C116	Practical I	0	0	6	3	6
6	C117	Practical II	0	0	6	3	6
<b>Total credits for core papers</b>						<b>22</b>	<b>28</b>
<b>Ability Enhancement Compulsory Courses (AECC)</b>							
6	CEN984A101	Communicative English – I	1	0	0	1	1
7	BHS984A101	Behavioural Science – I: Introduction to behavioural science	1	0	0	1	1
<b>Discipline Specific Elective (DSE) (ANY ONE TO BE SELECTED)</b>							
8	D101	Forest Biology & Tress Physiology	3	0	0	3	3
9	D102	Environmental Science	3	0	0	3	3
<b>TOTAL CREDITS</b>			<b>17</b>	<b>0</b>	<b>6</b>	<b>27</b>	<b>33</b>
<b>2<sup>ND</sup> SEMESTER</b>							
<b>Sl. No.</b>	<b>Subject Code</b>	<b>Names of papers</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TCP</b>
<b>Core papers</b>							
1	C201	Forest Systematics & Ethnobiology	4	0	0	4	4

2	C202	Climate Change & Forestry	4	0	0	4	4
3	C203	Agroforestry Principles & Systems	4	0	0	4	4
5	C214	Practical III	0	0	6	3	6
6	C215	Practical IV	0	0	6	3	6
<b>Total credits for core papers</b>						<b>18</b>	<b>24</b>
<b>Ability Enhancement Compulsory Courses (AECC)</b>							
6	CEN984A201	Communicative English – II	1	0	0	1	1
7	BHS984A202	Behavioural Science – II: Development of Individuals and Behavioural Skills	1	0	0	1	1
<b>Ability Enhancement Elective Courses (AEEC)</b>							
8	S221	<b>to be chosen from basket course</b>	2	0	0	2	2
<b>Discipline Specific Elective (DSE) (ANY ONE TO BE SELECTED)</b>							
9	D201	Forest soil and Watershed Technology	3	0	0	3	3
10	D202	Environmental Impact Assessment	3	0	0	3	3
<b>TOTAL CREDITS</b>			<b>19</b>	<b>0</b>	<b>6</b>	<b>25</b>	<b>31</b>

**Paper name: Forest ecology and Biodiversity Conservation**

**Paper code: FORESTRY C101**

**Credit: 4-0-0-4**

**Scheme of Evaluation: theory only**

Detailed syllabus:

Module	Course content	Lecture hours
I	<b>Introduction to forest ecology:</b> Concept of forest ecology, forest ecosystem, significance of forest and its resources; Forest productivity (primary and secondary productivity), Measurement of forest productivity; Methods for enumeration of forest community structure, forest diversity indices and regeneration status; Nutrient cycling in forest- Carbon and Nitrogen cycle, human influences on global carbon and nitrogen cycles, major impacts of global ecological changes on forests.	12
II	<b>Concept of forest and biodiversity conservation:</b> History of biodiversity conservation; Biodiversity- definition, levels and types; Conservation of natural resources (hotspot areas, wildlife sanctuaries, national parks, biosphere reserve); Global warming and forests- Green House Effect and its consequences, Ozone depletion, Conservations laws and acts. Forest genetics resources of India timber and non-timber species.	12
III	<b>Strategies for conserving forest genetic resources:</b> Documentation and evaluation of forests genetical resources (FGR), in-situ and ex-situ conservation of genetic resources- botanical garden, zoological garden, in vitro conservation: germplasm or gene bank, tissue culture; Biological diversity and its significance. Handling and storage of FGR. Intellectual property rights. Quarantine laws and FGR exchange.	12
IV	<b>Global approaches for forest and biodiversity conservation:</b> Global perspectives - International programmes for biodiversity conservation, convention on biological diversity (CBD), IUCN, CITES, ITTA, UNFCCC, Kyoto Protocol, Ramsar Convention on Wetlands, Cartagena Protocol on Bio-Safety 2000 (CPB); Indian perspectives - Indian initiatives in biodiversity conservation-biodiversity act 2002, Biodiversity Rules 2004, National biodiversity strategy and action plan (NBSAP), Plant Varieties Protection and Farmer's Rights Act, 2001, National biodiversity authority (NBA), Biodiversity management committee (BMC).	12
	TOTAL	48

Suggested Readings:

1. Odum, E. P., & Barrett, G. W. (1971). Fundamentals of ecology (Vol. 3, p. 5). Philadelphia: Saunders.
2. Kimmins, J. P. (1976). Forest Ecology. MacMillan.

3. Ramakrishnan, P. S. (1992). Shifting Agriculture and Sustainable Development. Man and Biosphere Series. The Parthenon Publ. Group.
4. Dhyani, S. N. (1994). Wildlife Management. Rawat Publ. 19
5. Khan, T.I. & Al-Azmi, D. N. (1999). Global Biodiversity Conservation Measures. Pointer Publ.
6. Nautiyal, S. & Koul, A. K. (1999). Forest Biodiversity and its Conservation Practices in India. Oriental Enterprise.
7. Agrawal, K. C. (2000). Wildlife of India: Conservation and Management. Nidhi Publishers, India.
8. Edward, O. G. (2004). Ex situ plant conservation. Island Press, Washington, DC.
9. Montagnini, F., & Jordan, C. F. (2005). Tropical forest ecology: the basis for conservation and management (Vol. 25275211). Berlin: Springer.
10. Anonymous (2006). Report of the National Forest Commission. Govt. of India.
11. Lugo, A. E., & Lowe, C. (Eds.). (2012). Tropical forests: management and ecology (Vol. 112). Springer Science & Business Media.
12. Sivaperuman, C. & Venkataraman, K. (Eds.). (2018). Indian Hotspots: Vertebrate Faunal Diversity, Conservation and Management Volume 2. Springer Singapore.

**Paper name: Forest resources & economics**

**Paper code: FORESTRY C102**

**Credit: 4-0-0-4**

**Scheme of Evaluation: theory only**

Detailed syllabus:

Module	Course content	Lecture hours
I	Concept of forest resources and its economics; Principles of microeconomics and its application in forest resource management; Demand, supply and marketing of forest products; Theory of capital and application in forest resource management; Domestic and international trade in forest products; Impact of socio-economic variables on forest appraisal and management decisions; Natural and environmental resource accounting –methods and implications; Bio-economy and circular economy- a global perspectives.	12
II	<b>Applied forest economics:</b> Application of operational research tools in evaluating forest management alternatives in public and private forest planning and valuation; Characterization and economic importance of selected order and Families of Dicots and Monocots I: Ranales (Magnoliaceae & Annonaceae), Guttiferales (Clusiaceae & Dipterocarpaceae), Malvales (Malvaceae & Sterculiaceae), Ruttales (Rutaceae & Meliaceae), Rosales (Rosaceae & Leguminosae).	12
III	<b>Ethnobiology:</b> Scope, objectives and methodologies of ethnobiology (Ethnobotany and Ethnozoology); Ethnobotany in relation to health care and drug discovery (Ethnomedicine & Ethnopharmacology), Contribution of wildlife products to human welfare; Hunting of wildlife;	12

	Importance and prospects of Ethnobiological studies in North Eastern India.	
IV	<b>Forest ecosystem services and their valuation:</b> Forest Goods and services- the concept and its evolution; History of development of Timber Extraction, Extraction methods, conversion of timber, Multiple applications of wood. Non-timber forest products (NTFPs)- Present production, their management, export and import of non-timber forest products, dependence of people on NTFPs; Important NTFPs: Gums, Resins, Bamboos, Canes, Oil seeds, Tannins, Dyes, Tendu leaves, Broom grass. Pulp and Paper, Lac and Shellac, Cutch & Katha, Cocoa, Alcoholic beverages.	12
	TOTAL	48

#### Suggested Readings:

1. Indian Forest Products, Vol. I & Vol. II, By ICFRE, Dehradun, 1970
2. Minor Forest Products of India by T. Krishnamurthy, Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi, 1993
3. Composite wood-Research and Development by K.S. Shukla and S.P. Singh, ICFRE Dehra Dun, 1993
4. Forests: The non-wood resources by A.P. Dwivedi, IBD Dehra Dun, 1992

<p><b>Paper name: Forest Biometry</b>  <b>Paper code: FORESTRY C103</b>  <b>Credit: 4-0-0-4</b>  <b>Scheme of Evaluation: theory only</b></p>
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#### Detailed syllabus:

Module	Course content	Lecture hours
I	Introduction, definition, objectives and scope of forest mensuration. Scales of measurement; Units of measurement, standards of accuracy implied in their expression; Measurement of single tree - objectives, standard rules governing measurement at breast height. Measurement of tree diameter and girth using rulers, callipers and tapes; Comparison between tape and calliper measurements; Measurements of upper stem diameter and instruments such as Ruler, Calliper, Pentaprism; Bark measurements - objectives, thickness, surface area and volume; Crown measurements - objectives, diameter, height, surface area and volume.	12
II	Volume tables-definition and their classification. Preparation of volume tables. Stand growth, site quality, site index, stand structure, yield tables and preparation of yield tables; Forest Biomass measurement; forest carbon sequestration, emission trading; Determination of age of trees; Tree growth measurements- objectives increment, determination of	12

	increment, stump analysis, stem analysis and increment boring; Measuring tree crops - objectives, diameter, diameter and girth classes, height measurement of crop, crop age and crop volume. Stand tables.	
III	Forest inventory- definition, objectives, kinds of enumeration; Sampling - definition, advantages, kinds of sampling, random sampling- (simple, stratified, multistage and multiphase sampling); Non random sampling (selective, systematic and sequential sampling) sampling design, size and shape of the sampling units; Point sampling - horizontal and vertical point sampling; Introduction to remote sensing and its application in forestry. Use of GPS in forest inventory; Measurement stand density. Simulation techniques. Growth and yield prediction models.	12
IV	Principles of forest management- scope and object of forest management, ecosystem management, development of forest management in India; Site quality evaluation and importance; Forest valuation and appraisal in regulated forests; National forest inventory- historical background and current challenges;	12
	TOTAL	48

#### Suggested Readings:

1. Chaturvedi, A.N and L.S. Khanna. 2011. Forest Mensuration and Biometry (5th edition). Khanna Bandhu. Dehra Dun. 364 pp.
2. Sampling Techniques for Forest Resource Inventory, Shiver and Borders, 1996, Wiley.
3. Forest Sampling Desk Reference, Johnson, CRC Press.
4. Ram Parkash 1983. Forest Surveying. International Book Distributor.
5. Sharpe GW, Hendee CW and Sharpe WE. 1986. Introduction to Forestry. McGraw-Hill.
6. Simmons CE. 1980. A Manual of Forest Mensuration. Bishen Singh Mahender Pal Singh, Dehradun
7. Prodan M. 1968. Forest Biometrics. Pergamn Press.
8. Loetsch I and Haller KE. 1964. Forest Inventory Vol. and Vol II. BLV Verlagsgesellschaft, München, Germany.
9. Campbell, J.B. (2002). Introduction to Remote Sensing (3rd edition). Taylor and Francis, London Environment System Research Institute, (1999). GIS for Everyone. Redlands, CA:ESRI

**Paper name: Principles of Silviculture**

**Paper code: FORESTRY C104**

**Credit: 4-0-0-4**

**Scheme of Evaluation: theory only**

#### Detailed syllabus:

Module	Course content	Lecture hours
I	<b>Introduction to silviculture:</b> Silviculture and its scope in forestry; Classification of Silvicultural systems; Topographic, climatic, edaphic	12

	and biotic factors; Silvicultural practices for tropical, subtropical, temperate and alpine forests; Major forests types of India –forest composition and structure.	
II	<b>Seed biology and forest regeneration:</b> Seed production, seed periodicity, seed dispersal, seed collection and processing, seed dormancy, seed germination, methods of seed viability estimation and measurement of seed vigour; Regeneration- Natural and Artificial regeneration. General nursery techniques. Tending and cultural operations in forestry; Factors affecting regeneration; Gap-phase regeneration; Regeneration survey; Intermediate operations and their effects on growth and yield; Control of under-storey and over-storey vegetation.	12
III	<b>Modern techniques in silviculture:</b> Stand establishment; Technique in early stand establishment; Advances in coppice Silviculture; Stand protection and health management; Judging successful establishment of forests; Methods of thinning and their impact on wood quality and yield; Evaluation of active and passive site preparation; Analysis of different techniques of Silviculture in forest stand management.	12
IV	<b>Silviculture of some economically important species in India:</b> Silvics of important tree species-Distribution, morphology, phenology, growth behaviour, silviculture characters, nursery techniques, protection and utilization of the following tree species- <i>Cedrus deodara</i> , <i>Pinus kesiya</i> , <i>Gmelina arborea</i> , <i>Shorea robusta</i> , <i>Tectona grandis</i> , <i>Dalbergia sissoo</i> , <i>Acacia</i> spp., <i>Albizia</i> spp., <i>Terminalia</i> spp., <i>Dipterocarpus</i> spp., Bamboo species.	12
	TOTAL	48

Suggested Readings:

1. Dwivedi, A. P. (1993). A Text Book of Silviculture. International Book Distributors, Dehradun.
2. Ford, E. D. (1984). Nutrition of Plantation Forests. Academic Press.
3. Kadambi, K. (1993). Silviculture and Management of Teak. Vedams Books International.
4. Khanna, L. S. (1996). Principle and Practice of Silviculture. International Book Distributors.
5. Prakash, R. and Khanna, L. S. (1983). Theory and Practices of Silvicultural Systems. International Book Distributors, Dehradun.

<p><b>Paper name: PRACTICAL I</b>  <b>Paper code: FORESTRY- C116</b>  <b>Credit: 0-0-6-3</b>  <b>Scheme of Evaluation: Practical only (P)</b></p>
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Detailed syllabus:



Module	Course content	Lecture hours
I	1. Study of forest community structure and its characteristics- Determination of frequency/Density/Abundance/IVI of vegetation. 2. Measurement of Different Biodiversity Indices (Simpson's Biodiversity Index, Shannon's index, etc.). 3. Determine the community structure of a forest stand 4. Check listing and herbarium preparation of flora in and around RGU campus.	18
II	5. Phenological study of some important tree species in and around RGU campus 6. Measurement of biomass and productivity, 7. Determination of the litter accumulation/decomposition in a forest stand. 8. Study of regeneration status of forest stand.	18
III	9. Methods of collection of water and analysis of physio-chemical parameters- pH, Temperature, DO, CO <sub>2</sub> , BOD, salinity, turbidity. 10. Methods of collection of soil and analysis of physio-chemical parameters- texture, pH, moisture, N, P, K, heavy-metals. 11. Estimation of plankton frequency in the aquatic system. 12. Estimation of the carbon stock in forest ecosystem.	18
IV	11. Trip to nearby forested areas of the state to study forest vegetation, collection and preservation of specimen for submitted a field report. 12. Visit to nearby in- situ conservation site and submission of a report. 13. Visit to nearby ex-situ conservation site and submission of a report.	18
	TOTAL	72

**Paper name: PRACTICAL II**  
**Paper code: FORESTRY- C117**  
**Credit: 0-0-6-3**  
**Scheme of Evaluation: Practical only (P)**

Detailed syllabus:

Module	Course content	Lecture hours
I	1. Identification on different types of coppices in the forest. 2. Identification of tree seeds and study of their physical characteristics such as seed moisture, weight, and purity analysis. 3. Study on germination behavior of tree seeds in seed body and controlled conditions. 4. Determination of seed viability and vigour tests	18
II	5. Visit to different sites to study silvicultural operations undertaken as part of forest management.	18

	6. Regeneration survey of mixed and pure forests 7. Quantification of regeneration and stand establishment 8. Calculations of volume of felled as well as standing trees.	
III	9. Volume table preparation. 10. Preparation of yield and stand table. 11. Measurement of crown density and crown ratios. 12. Crown profiling of trees and stand. 13. Dendrochronological studies.	18
IV	14. Handling of GPS 15. Range finder for tree height measurement. 16. Measurement of tree basal area using vernier caliper.	18
	TOTAL	72

**Paper name: Forest Biology & Tree Physiology**

**Paper code: FORESTRY D101**

**Credit: 3-0-0-3**

**Scheme of Evaluation: theory only**

Detailed syllabus:

Module	Course content	Lecture hours
I	<b>Introduction:</b> Tree morphology and structure, Primary growth; Secondary growth; Growth, phases of growth, growth curve, factors affecting growth- Wood formation;  <b>Plant Nutrients:</b> Mineral nutrients- absorption, translocation and utilization of mineral salts, Nitrogen metabolism, Water relation; Transport and translocation of water and solute, Salt and drought tolerance physiology in relation to production of biomass; Transpiration and osmo-regulation in relation to stress physiology.	12
II	<b>Growth, development and differentiation:</b> Study of tree structure, growth, development and function, how these are related to the environment and to cultural practices; Factors affecting growth of trees, Phytohormones- Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic Acid, Phytochrome; their mechanism of action, Role of growth hormones in vegetative propagation; Signaling and integration: auxin and GA, Biosynthesis and elicitors: ethylene and ABA	12
III	<b>Plant biochemistry and metabolism:</b> Photosynthesis- Carbon partitioning, light reactions, general concepts, organization of light absorbing, mechanisms of electron transport, the carbon reactions; The Calvin-Benson cycle. Inorganic carbon-concentrating mechanisms- the C <sub>3</sub> , C <sub>4</sub> and CAM carbon cycle. The impact of environmental conditions on photosynthesis; Overview of plant respiration- Glycolysis, the citric acid cycle, the oxidative pentose phosphate pathway, mitochondrial	12

	electron transport and ATP synthesis; Respiration in intact plants and tissues. Photorespiration.	
IV	<b>Reproductive Physiology:</b> Physiology of flowering, Pollen Biology, Regulation of sexuality, photoperiodism in trees relating to the growth and regeneration, Vernalisation, Physiology of Embryo growth, Fruit Development and Ripening, Seed physiology – Germination and seed dormancy; The mechanism and regulation of seed dormancy and germination, molecular dissection of seed quality; The biophysical basis of seed longevity bud dormancy, abscission and senescence.	12
	TOTAL	48

#### Suggested Readings:

1. The Embryology of Angiosperm- S. P Bhatnagar, P K Dantu S. S Bhojwani,
2. The Plant Physiology – Ross and Salisbury
3. Textbook of Plant Physiology – C.P. Mallik and A.K. Srivastava, Kalyani Publisher, New Delhi
4. Physiology of Woody Plants – Dr. Stephen G. Pallardy, Science Direct
5. Tree Physiology - Meinzer, Frederick C., Niinemets, Ülo; Springer
6. Forest tree Physiology – E. Dreyer, Elsevier

<p><b>Paper name: Environmental Science</b>  <b>Paper code: FORESTRY D102</b>  <b>Credit: 3-0-0-3</b>  <b>Scheme of Evaluation: theory only</b></p>
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#### Detailed syllabus:

Module	Course content	Lecture hours
I	<b>Earth and its Atmosphere:</b> Types of rock- weathering and erosion processes; Types and formation of soils and soil profile. Earthquakes, Volcanoes, Landslides and Floods- and their impact on environment; Impact of mining on environment; Groundwater- occurrence; Salt water intrusion; Earth's atmosphere, composition and thermal stratification, atmosphere and the earth's radiation balance, circulation of atmosphere; Photochemistry of nitrogen oxides, oxygen, ozone and chlorides in the atmosphere.	12
II	<b>Global Environmental Change.</b> Ozone layer: Causes of depletion and consequences and its mitigation; Effects of UV on plants, microbes, animals, human health and materials; Climate change: Drivers of climate change; Greenhouse gases and their sources and effects; International efforts on climate change issues; Biomagnification, eutrophication, acid rain and its effect; National air monitoring programme; air pollution control equipment's; clean coal technology, coal conversion, industrial clean-up technology; control of vehicular emission.	12

III	<b>Environmental Monitoring and Management</b> Ambient air monitoring; Methods of collection and analyses of gaseous and particulate pollutants. Methods of collection of water samples and analyses of its physio-chemical characteristics. Methods of collection of soil samples and analyses of physio-chemical characteristics; Bio-monitoring and bio-indication; environmental management: Principles and strategies; environmental clearance for establishing industries; Environmental Impact Assessment (EIA); EIA guidelines 1994, environmental taxes.	12
IV	<b>Society and Environment:</b> Social perspectives of environment: Global and Indian issues; sustainable development: Concept, components and strategies; Social impacts of growing human population and affluence; Social impacts of water crisis, global warming, problems related to major dams and other developmental projects, resettlement and rehabilitation. Environment and human health: epidemiological issues, women and child welfare, Environmental education, Environmental ethics, people's participation in resource conservation and environmental protection.	12
	TOTAL	48

Suggested Readings:

1. Mahato B, Pandey BN, Singh LB, Pandey PN and Singh RK. 2010. Text Book of Environmental Pollution. Narendra Publishing House, Delhi.
2. Pandey PN. 2009. Biodiversity and Environment Ecology. Narendra Publishing House, Delhi.
3. Perry DA, Oren R and Hart SC. 2008.
4. Wright, R. T. (1974). Environmental science. Galgotia Publications.
5. O'riordan, T. (2014). Environmental science for environmental management. Routledge.
6. Chiras, D. D. (2009). Environmental science. Jones & Bartlett Publishers.
7. Miller, G. T., & Spoolman, S. (2010). Environmental science. Brooks/Cole, Cengage Learning.
8. K. S. Valdiya. 1987. Environmental Geology. Tata McGraw-Hill.