



### List of Revised Courses

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

**Program Name : B. Sc. (Forestry)**

**Academic Year : 2018-19**

### **List of Revised Courses**

Sr. No.	Course Code	Name of the Course
01.	NR/FR/CR/01/02/L	Fundamentals of Soil Science
02.	NR/FR/CR/02/04/L	Introductory Botany
03.	NR/FR/CR/02/05/L	Forest Ecology and Biodiversity Conservation
04.	NR/FR/CR/02/02/L	Environmental Studies
05.	NR/FR/GE/03/01/L	Ethano Forestry
06.	NR/FR/CR/06/19/L	Forest Tree Improvement and Biotechnology
07.	NR/FR/CR/06/16/L	Forest Pathology and Entomology
08.	NR/FR/DS/06/03/L	Carbon Forestry and Global Climate Change
09.	NR/FR/CR/07/20/L	Biostatistics



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

**Academic Year : 2018-19**

**School : School of Natural Resources**

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

**Date and Time : July 26, 2018 - 11:00 AM**

**Venue : E-Class Room**

The scheduled meeting of member of Board of Studies (BoS) of Department of Forestry, Wildlife and Environmental Sciences, School of Studies of Natural Resources, Guru Ghasidas Vishwavidyalaya, Bilaspur was held to design and discuss the B. Sc (Forestry) Four Years Degree Programme and syllabi.

The following members were present in the meeting:

1. Prof. Lalji Singh (External Expert Member BoS, Dept. of Agroforestry, IGKV, Raipur)
2. Prof. S. S. Singh (Member BoS, Dept. of Forestry, Wildlife and Environmental Sciences)
3. Dr. S. C. Tiwari (HOD, Associate Prof., Dept. of Forestry, Wildlife and Environmental Sciences -cum Chairman, BOS)
4. Dr S. S. Dhuria (Member BoS, Associate Professor, Dept. of Forestry, Wildlife and Environmental Sciences)
5. Dr. Gunjan Patil (Member BoS, Assistant Professor, Dept. of Forestry, Wildlife and Environmental Sciences)

Following points were discussed during the meeting

1. The syllabus of B. Sc. Forestry (4 years/ 8 Semesters) framed as per the guidelines of CBCS pattern recommended by UGC has been discussed thoroughly and was passed by the committee for the implementation from academic session 2018-19.
2. The course curriculum of M. Sc Forestry and Environmental Sciences was discussed and it was resolved that this course is well framed and contemporary with the course curriculum of other forestry institution in the country. Since it is at Forestry, Wildlife and Environmental Sciences at par with the needs of the current scenario so presently needs no revision.
3. The committee also resolved that the syllabus of M. Sc. Forestry and Environmental Sciences will be the syllabus for VRET examination of PhD programme in forestry.



The committee discussed and approved the scheme and syllabi. The following courses were revised in the of B. Sc. (Forestry) Four year degree programme :

NR/FR/CR/01/02/L	Fundamentals of Soil Science
NR/FR/CR/02/04/L	Introductory Botany
NR/FR/CR/02/05/L	Forest Ecology and Biodiversity Conservation
NR/FR/CR/02/02/L	Environmental Studies
NR/FR/GE/03/01/L	Ethano Forestry
NR/FR/CR/06/19/L	Forest Tree Improvement and Biotechnology
NR/FR/CR/06/16/L	Forest Pathology and Entomology
NR/FR/DS/06/03/L	Carbon Forestry and Global Climate Change
NR/FR/CR/07/20/L	Biostatistics

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**Head**

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Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Signature & Seal of HoD



**Scheme and Syllabus**

**B.Sc. Forestry (4 -Year / 8- Semester) CBCS Programme**

Semester	Course Opted	Course Code	Name of the course	Credit	Hour / week	
I	Core-01	NR/FR/CR/01/01/L	Principles and Practices of Silviculture	4	4	
	Core-01 Practical	NR/FR/CR/01/01/P		2	4	
	Core-02	NR/FR/CR/01/02/L	Fundamentals of Soil Science	4	4	
	Core-02 Practical	NR/FR/CR/01/02/P		2	4	
	Ability Enhancement Compulsory (CC-01)	NR/FR/CC/01/L	English Communication	4	4	
	Extracurricular Activity (EC-01)	NR/FR/EC/01/01/P	ECA-Extracurricular activity Field visit/ NSS/ Swachhata/ Physical Education/ Plantation Activities	2	2	
	<b>TOTAL</b>				<b>24</b>	<b>26</b>
II	Core-04	NR/FR/CR/02/04/L	Introductory Botany	4	4	
	Core-04 Practical	NR/FR/CR/02/04/P		2	4	
	Core-05	NR/FR/CR/02/05/L	Forest Ecology and Biodiversity Conservation	4	4	
	Core-05 Practical	NR/FR/CR/02/05/P		2	4	
	Core-06	NR/FR/CR/02/06/L	Fundamentals of Wildlife	4	4	
	Core-06 Practical	NR/FR/CR/02/06/P		2	4	
	Ability Enhancement Compulsory (CC-02)	NR/FR/CC/02/02/L	Environmental Studies	4	4	
	Extracurricular Activity- (EC-02)	NR/FR/EC/02/02/P	ECA-Extracurricular activity/ Field visit/ NSS/ Swachhata/ vocational Training/ Sports/ Plantation activities	2	4	
	<b>SUMMER (NC) Internship: 15 days</b>				2	100
	<b>Total</b>				<b>26</b>	<b>132</b>
III	Core-07	NR/FR/CR/03/07/L	Forest Mensuration	4	4	
	Core-07 Practical	NR/FR/CR/03/07/P		2	4	
	Core-08	NR/FR/CR/03/08/L	Cytogenetics and Plant Breeding	4	4	
	Core-08 Practical	NR/FR/CR/03/08/P		2	4	

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Practical					
Core -09	NR/FR/CR/03/09/L	Forest Management	4	4	
Core -09 Practical	NR/FR/CR/03/09/P		2	4	
Generic Elective- (GE-01)	NR/FR/GE/03/01/L	Ethnoforestry	4	4	
Generic Elective - Practical (GE-01) P	NR/FR/GE/03/01/P		2	4	
Skill Enhancement Course(SC- 01)	NR/FR/SC/03/01/L	Nursery Practices and Plantation management	2	2	
Skill Enhancement Course(SC- 01) P	NR/FR/SC/03/01/P		4	8	
		<b>Total</b>	<b>30</b>	<b>42</b>	
IV	Core -010	NR/FR/CR/04/10/L	Fundamentals of Wood Science	4	4
	Core -010 Practical	NR/FR/CR/04/10/P		2	4
	Core -011	NR/FR/CR/04/11/L	Nursery Management and Commercial Forestry	4	4
	Core -011 Practical	NR/FR/CR/04/11/P		2	4
	Core -012	NR/FR/CR/04/12/L	Application of Remote Sensing and GIS in Forest and Watershed Management	4	4
	Core -012 Practical	NR/FR/CR/04/12/P		2	4
	Generic Elective- (GE-02)	NR/FR/GE/04/02/L	Non Wood Forest Products and Utilization	4	4
	Generic Elective Practical(GE- 02) P	NR/FR/GE/04/02/P		2	
	SUMMER Internship: 15 days (NG)	Swayam Swachhta/NSS/Industrial visit/ Others	2		
		<b>TOTAL</b>	<b>26</b>	<b>130</b>	
V	Core -013	NR/FR/CR/05/13/L	Wildlife Management	4	4
	Core -013 Practical	NR/FR/CR/05/13/P		2	4
	Core -14	NR/FR/CR/05/14/L	Wood Technology	4	4

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Core -14 Practical	NR/FR/CR/05/14/P		2	4
Core -15	NR/FR/CR/05/15/L	Forest Tree Seed Technology	4	4
Core -15 Practical	NR/FR/CR/05/15/P		2	4
Discipline Specific Elective (DS-01)	NR/FR/DS/05/01/L	Meteorology and Crop Production	4	4
Discipline Specific Elective (DS-01) P	NR/FR/DS/05/01/P		2	4
Discipline Specific Elective- (DS-02)	NR/FR/DS/05/02/L	Basic Concepts of Horticultural and Landscaping	-----	-----
Discipline Specific Elective- (DS-02) P	NR/FR/DS/05/02/P		-	-
<b>TOTAL</b>			<b>24</b>	<b>32</b>

Core -016	NR/FR/CR/06/16/L	Forest Pathology and Entomology	4	4
Core -016 Practical	NR/FR/CR/06/16/P		2	4
Core -017	NR/FR/CR/06/17/L	Agroforestry	4	4
Core -017 Practical	NR/FR/CR/06/17/P		2	4
Core -018	NR/FR/CR/06/18/L	Forest Economics	4	4
Core -018 Practical	NR/FR/CR/06/18/P		2	4
Core -019	NR/FR/CR/06/19/L	Forest Tree Improvement and Biotechnology	4	4
Core -019 Practical	NR/FR/CR/06/19/P		2	4
Discipline Specific Elective- (DS-03)	NR/FR/DS/06/03/L	Carbon forestry and global climate change	4	4
(DS-03) P	NR/FR/DS/06/03/P		2	4
Discipline Specific Elective- (DS-04)	NR/FR/DS/06/04/L	Community Forestry	---	---
(DS-04) P	NR/FR/DS/06/04/P		-	-
<b>TOTAL</b>			<b>30</b>	<b>40</b>
Core -020	NR/FR/CR/07/20/L	Biostatistics	4	4
Core -020 Practical	NR/FR/CR/07/20/P		2	4

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## SEMESTER – I

### PRINCIPLES AND PRACTICES OF SILVICULTURE

CR: 4 + 2

Definition, objective and scope of silviculture. Status of forest in India and their role. Forest types and their classification. Trees and their distinguishing features. Site factors and their interactions. Climatic factors and its role. Edaphic factors, Physiographic factors and its influences. Biotic factors- influence of plant insect, wild animals, man and domestic animals. Impact of controlled burning, grazing, influence of forest on vegetation. Microclimate and its effect.

Regeneration: Natural, artificial and factors affecting it. Regeneration Survey. Tending operation: Weeding, cleaning, thinning and improvement felling.

#### PRACTICAL

Acquaintance with various technical terms. Study of forest composition. Recording the observations on phenological characteristics of different tree species. Study of site factors. Study of the natural regeneration, afforestation and reforestation success. Lay outting of nursery bed and soil preparation, types of seed sowing in nursery bed.

#### Suggested Readings:

1. Khanna, L. S. (1984). Principles and Practice of Silviculture, Khanna Bhandu, Dehra Dun.
2. Ram Prakash and L.S. Khanna. (1991) Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun.
3. Dwivedi, A.P. (1993). A Text Book of Silviculture, International Book Distributors, Dehradun.
4. Dwivedi, A. P. (1992). Principles and Practice of Indian Silviculture, Surya Publication.
5. Champman, G.W. and Allan, T.G. (1978). Establishment Techniques for Forest Plantation F.A.O Forestry Paper No.8. F.A.O Rome.
6. Pradip Krishan (2013). Jungle trees of central India. Penguin Book distributors, India.

### FUNDAMENTALS OF SOIL SCIENCE

CR: 4 + 2

Composition of earth's crust, soil as natural medium for plant growth, major components of soil, Soil minerals formation. Weathering of rocks and minerals-weathering factor, physical-Chemical-biological weathering and procedure of soil formation. Physical properties-bulk density, soil porosity, soil structure, soil consistency, plasticity. Soil organic matters and litter decomposition, pH, nutrient availability and absorption, soil buffering capacity, Soil water forms- soil moisture, wilting point- field

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capacity- moisture, water holding capacity, Soil orders- land capability classification. Problem of soils: salted, permeable, flooded and sandy soils.

Forest soils Vs cultivated soils. Soil colloids and exchange phenomenon. Essential nutrient elements occurrence, availability and their functions. Diagnosis of nutrient deficiencies-visual symptoms, soil fertility evaluation methods. Site productivity and nutrient cycling in forest soils. Forest soil environment-distribution of various microorganisms, rhizosphere and phyllosphere concept. Mineral Transformation-carbon cycle, N<sub>2</sub>-cycle, P-cycle, S-cycle. Bio-fertilizers -their importance. Nitrogen fixation-Rhizobium-tree legume symbiosis, Frankia - non-legume symbiosis, asymbiotic and associative N<sub>2</sub> fixation. Mycorrhiza: types, biology and importance with specific relevance to tree seed crops.

#### PRACTICAL

Identification of rocks and minerals; Collection and preparation of soil samples, soil analysis for moisture, color, bulk density, organic matter, pH, EC, Textural analysis.

Study the forest soil profile. Determination of available N, P & K content of soil, basic sterilization techniques, culturing and maintenance of micro organism occurring in soil, staining methods, study of decomposition of forest litter by CO<sub>2</sub>- evolution method, preparation and inoculation technique for mycorrhiza and biofertilizers.

#### Suggested Readings:

1. Armonson, K.A. Forest Soils, (1977). IBD Publisher, Dehradun.
2. Gale, M.R. Forest Soil Research, (2006). IBD Publisher, Dehradun.
3. Brady, N.C and Weil, R.R. (2009). Nature and properties of Soil. Printice Hall of India.
4. Biswas, T.D. and S.K. Mukherjee (2001). Text book of soil Science. Tata Mc. Grew Hill, Publishing Co., New Delhi.
5. Wild, A. (1988) Soil conditions and plant growth. 11th edition, ELBS, London.
6. Mark Ashman and Geeta Puri (2008). A clear and concise introduction to soil science. Wiley-Blackwell publishers.
7. A.K.Kolay (1997) Basic concepts of Soil science. Wiley Estarn Ltd.
8. Das, D.K (2013) Introductory Soil Science. Kalyani publishers.
9. Havlin J.L, and Tisdale S.L. (2013). Soil fertility and Fertilizers. Amazon.com
10. Halvin J and Pearson (2005). Soil fertility and fertilizers: An introduction to nutrient management. Printice Hall of India.
11. Biswas, T.D. and S.K. Mukherjee (1992). Text book soil fertility. Tata Mc. Grew Hill, Publishing Co., New Delhi.

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## SEMESTER – II

### INTRODUCTORY BOTANY

CR: 4 + 2

Introduction to Botany and general classification of plants. Morphology of different parts of typical flowering plant. Structure and types of plant tissues internal structure of dicot, and monocot stems, root and a typical leaf. Significance of life cycles with special reference to alternation of generation in Nostoc, Rhizopus, Funaria, Adiantum, Pinus and in a flowering plant. Importance of plants in relation to environment.

Water relation in plants. Absorption of water, ascents of sap. Stomata, structure, mechanism of opening and closing of stomata, guttation, transpiration, factors affecting transpiration.. Photosynthesis, its importance and factors affecting it. Photorespiration. Mechanism of Respiration and factors affecting it. Phyto hormones and their role in plant growth.

#### PRACTICAL

Morphological studies of root, stem, leaf and flowers. Studies of permanent slides of histology and anatomy. General survey of the local vegetation. A field trip during the semester. Osmosis- endo and exo-osmosis demonstration, Plasmolysis- demonstration, Transpiration rate, Measuring the rate of photosynthesis in plant species.

#### Suggested Readings:

1. Shiva, M.P. A Handbook of Systematic Botany, (1986).IBD Publisher, Dehradun.
2. NCERT.A textbook of Botany.
3. Strasburger, Schenck, Noll, Fritz, Karsten and Lang, W. H.(2010). A textbook of Botany. Academic Press, New York.
4. Singh, V and Jain D.K. (2013) Biology. Nageen Prakashan Pvt Ltd. Meerut, India.
5. Singh Pande Jain (2002).A textbook of Botany. Rastogi publications, Meerut, India
6. Taiz, L., Zeiger, E., Ian M. Moller and Angus Murphy-Sixth ed. (2015). Plant Physiology and Development. published by Sunderland:Sinuaer Associates
7. Taiz, L. and Zeiger, E (2010) .Plant Physiology.Sunderland:Sinuaer Associates.
8. Verma V. (2009) Textbook of Plant Physiology. Ane books Pvt. Ltd. New Delhi .
9. Salisbury, F and Ross Cleon (1988) .Plant Physiology. Oxford and IBH,publishers.
10. William G. Hopkins and Norman P A Huner (2008).Introduction to plant physiology.Published by Jhon Wiley and sons inc.
11. Majumdar (de) Manisha (2011) Plant physiology.E-book on www.bookrix.com.

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**FOREST ECOLOGY AND BIODIVERSITY CONSERVATION CR: 4 + 2**

Concept of ecology, levels of biological organization, Ecosystem structure and function. Population ecology and its importance in forest management, plant community structure, Ecological succession, Biodiversity; conservation measurement of diversity and diversity indices. Biodiversity hotspots and biogeographic zones of India. Principles of conservation, Conservation\* – efforts in India and worldwide. Rangeland ecology, importance of rangeland, Indian rangelands status and management. Rangeland inventory, rangeland improvement.

**PRACTICAL**

Study of Forest composition; Phytosociological study. Measurement of diversity of plants in a nearby forest; Study of succession in field and water bodies; Visit to different ecosystems. Identification of grasses. Rangeland inventory making. Determination of carrying capacity of rangelands, Indicator of heavy grazing.

**Suggested Readings:**

1. Mishra, R. (1968) Ecology Work Book Oxford and IBH Publishing Co, Calcutta.
2. Odum, E.P (1983). Basic Ecology. Saunders College Publishing, Holt Saunders, Japan.
3. Odum, E.P. (1983) Fundamentals of Ecology, Natraj Publisher, Dehradun
4. Kumar and Asija. Biodiversity – Principles and conservation. Published by Updesh Purohit for Agrobios, Jodhpur, India.
5. Ashok Malik (2008) Dynamics of forest ecosystems. Today and Tomorrow publishers, New Delhi.
6. Vijendra Das, LD (1998). Forage crops. International Book Distributors, Dehradun.
7. Singh, J. S., Singh, S. P. and Gupta, S. R. 2014. Ecology environmental science and conservation. S. Chand publication.

**FUNDAMENTALS OF WILDLIFE**

**CR: 4 + 2**

Introduction: Definition of wildlife, free living, captive, domesticated and feral animals. Justification of wildlife conservation, uses, values and negative impact of wildlife. Zoogeographic regions and biomes

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6. Robert, A.W. (1979). The ecology and evolution of animal behavior. Gordon and Breach, London, California, U.S.A.  
7. Robert, G.H. (1978). Wildlife management. W.H. Freeman and Co., San Francisco, U.S.A.

**ENVIRONMENTAL STUDIES**

**CR: 4**

Introduction to environmental studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. Ecosystems: Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Natural Resources Renewable and Non-renewable Resources: Land resources and land use change; Land degradation, soil erosion and desertification, Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies. Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India;

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Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value. Environmental Pollution: Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies. Environmental Policies & Practices. Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, human wildlife conflicts in Indian context. Human Communities and the Environment, Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements Chipko, silent valley, Bishnois of Rajasthan. Environmental ethics: role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Field work: Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river etc.

**Suggested Readings:**

1. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
2. Grumbine, R. Edward, and Pasdit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
3. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
4. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.

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**ETHNOFORESTRY**

CR: 4 + 2

Forest and tribes- their relationship, Major tribes in India and Chhattisgarh. Forest ecosystem and cottage industries. Role of tribes in forest protection, development and conservation. Tribal welfare and social forestry, Tribal and co-operative movements. History of tribal welfare and administration, forest & tribes. Seed and biofuels, Herbal medicines in ethnomedical practices, Edible wild fruits, Wild mushrooms, Natural dyes, Tasar cultivation, Economic uses of grasses, Non wood forest products. Ethnoforestry & sustainable management.

**PRACTICAL**

Morphological description and identification of various medicinal plants. Collection of medicinal plants and plants part from natural habitats. Survey and study of nursery techniques of medicinal plants. Harvesting, drying, grading, storage and processing techniques. Study of plants parts used in drugs

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**FOREST TREE IMPROVEMENT AND BIOTECHNOLOGY**

CR: 4 + 2

Reproduction in trees. Pollination in trees. Inbreed and outbreed population in forest trees. Genetic variability and its role in tree improvement. Qualitative and quantitative traits in forest trees. Heritability, genetic advance, genetic gain, combining ability and their application. Geographic variation: Provenance, seed source, race, Genetic, environmental and phenotypic expression of trees. Plus tree selection, progeny trials. Forest Genetic Resources and its Conservation. Plant tissue culture - culture media and its formation, cell/tissue culture, haploid culture, basics of Genetic Engineering- Vectors: plasmid, bacteriophage and cosmids. Genetic code. Genetic Engineering. Methods of gene transfer: direct and indirect genetic engineering, gene cloning and polymerase chain reaction. Recombinant DNA Technology, Role of Genetic Engineering in Forest Tree Improvement

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**PRACTICAL:**

Floral biology & phenological observations in some important species. Estimation of pollen viability. Different breeding methods flowchart. Species and provenance selection techniques. Vegetative propagation techniques and tree improvement. Estimation of phenotypic and genotypic coefficient of variation. Exercise in plus tree selection. Protocol and preparation of culture medium, Preparation of stock solutions. Sterilization techniques, preparation of culture medium for establishment of explants of forestry plants, multiplication of shoots, and callus culture.

**Suggested Readings:**

1. Agrawal, P.K. and M. Dadlani (1987). Techniques in Seed Science and Technology, South Asian Publishers, Delhi.
2. Agrawal, R.L. (1996) Seed Technology. Oxford & IBH, Publishing Co., New Delhi.
3. Lars Schmidt (2000) Guide to Handling of tropical and sub-tropical forest seeds. Danida Forest Seed Centre, Denmark.
4. Zobel, B.J. and Talbert, J. (1984) Applied Forest Tree Improvement. John Wiley & Sons, New York.
5. FAO. (1985) Forest Tree Improvement, FAO Publication, Rome, Italy.
6. Fins, L., Friedman, S.T. and Brotschol, J.V. (1992) Handbook of Quantitative Forest Genetics, Klumer Academy, Dordrach, London.
7. Mandal, A.K. and Gibson, G.L.(eds) (1997). Forest Genetics and Tree Breeding. CBS Publi. & Distr., New Delhi
8. Khan I M (2014) Forest Biotechnology. Today and Tommorrow publishers, New Delhi
9. Wright, J.W. (1976) Introduction to Forest Genetics. Academic Press, New York.
10. White, T.M. and G.R. Hodges. (1989) Predicting breeding values with application in forest



## SEMESTER – VI

### FOREST PATHOLOGY AND ENTOMOLOGY

CR: 4 + 2

Relation of plant pathology with forest pathology and other sciences, classification of tree diseases. General characteristics and reproduction of plant pathogens: fungi, bacteria, viruses. Important characters of ascomycetes and basidiomycetes, Dissemination and survival of plant pathogens. Concept of tree disease and types of wood decay.

Definition, importance and scope of Forest Entomology. Classification of forest pests: types of damages and symptoms, factors for outbreak of pests.

Symptoms, etiology and control of diseases/disorders and insect pests of important tree species (Teak, *Dalbergia*, *Eucalyptus*, Sal, and *Acacia*) Fungicides, methods of their application. Principles and techniques of Integrated Pest Management in forests.

Symptoms, etiology and management of diseases of important tree species like Teak, *Dalbergia sp.*, *Acacia spp.*, Sal, Pines, Deodar, *Eucalyptus*. Types of wood decay, Principles of disease management, Fungicides and their use in nurseries and plantation.

#### PRACTICAL

Study of different pathological instruments, collection, observation and preservation of diseased specimen and observation of other pathogenic structure: microscopic characters of pathogen (fungi, Bacteria) preparation of culture media, isolation and sub culturing of pathogens; methods of inoculation and Symptom, sign and diagnosis of tree disease.

Study of different types of insects and their collection. Study of insecticides and their formulations. plant protection appliances; Study of insect pests of forest seeds; Study of insect pests of forest nurseries; Study of insect pests of standing trees, freshly felled trees and finished products, Visit to forest nurseries and plantations.

#### Suggested Readings:

1. Bakshi, B.K. Forest Pathology. (1976) Principles and Practices in Forestry. Controller of Publications, New Delhi.
2. Khanna, L.S. (1984) Forest Protection, Khanna Bandhu, Dehra Dun.
3. Beeson, C.F.C. (1941) Forest Insects of India, The Ecology and Control of the diseases.



**CARBON FORESTRY AND GLOBAL CLIMATE CHANGE**

**CR: 4 + 2**

Forests, Carbon and global climate. Forests and global carbon cycle. The key components of Forest Carbon: Carbon organic & inorganic, Carbon Source, Carbon Flow, Carbon Flux, Carbon Sink, Carbon Offset, Carbon Fertilization, Carbon footprint, Carbon Capture and Sequestration(CCS), Impacts of stand management on tree carbon stocks, Carbon in Woody debris and litter, Bio Soil – a new forest soil survey. Trees and Forests as collectors of carbon. Forest operations effects on carbon flux.

Handwritten signatures and dates: "Ghosh" with a date "26/7/18" and "26", "S Singh" with a date "26/7/18", and another signature "S" with a date "26/7/18".

The dynamics of carbon accumulation in tropical and temperate forests. Forest Soils as Carbon Reservoirs. Carbon Trade, Carbon Budget, Carbon Marketing, Carbon Dioxide Equivalent. The Potential Contribution of Indian Forests in carbon forestry. Carbon in Wood Products. Tree species wise Database for carbon stock. Carbon neutrality, carbon offset and carbon trading schemes. Forest Carbon management. Social Value Of forest Carbon. **Global Climate Change: Science and Politics, Earth reservoirs: the basics, Climate change adaptation and mitigation. Mechanisms (CDM and REDD+), natural GHG effects, climate change: models, theories, facts and politics, Multilateral Agreements on Climate Change**

**PRACTICAL**

Estimation of carbon content (organic/inorganic) in a wood, soil, litter and other forest based products, Sequestration of carbon in harvested wood products, Estimation of carbon flux, and CCS of forest trees/stands. Preparation of carbon inventories of different forest trees/stands. Establishment of forest carbon database, Survey to study the political/social context of carbon forestry. **Biodiversity, migration and climate change assessment in different forest areas**

**Suggested Readings:**

1. Ashton, M.S., Tyrrell, M.L., Spalding, D., Gentry, B. (Eds.) (2012) Managing Forest Carbon in a Changing Climate. Springer Dordrecht Heidelberg London New York
2. H S Gupta, M Yadav, M Verma, A David, U K Sharma and and C P Kal (2014) Science and Business of Carbon Forestry. TERI press, New Delhi.
3. Malti Goel, M Sudhakar, and R V Shahi (eds) (2006) Carbon Capture, Storage and Utilization: a possible climate change. UNFCCC report -2006.
4. Thompson, D. And Matthews, R.W. (1989).The storage of carbon in trees and timber. Research Information Note 160. Forestry Commission, Edinburgh.
5. Schlamadinger B. And Marland G. (2000).Land use and global climate change: Forests, Land Management, and the Kyoto Protocol. Pew Center on Global Climate Change ([www.pewclimate.org/projects/land\\_use.cfm](http://www.pewclimate.org/projects/land_use.cfm)).
6. Nabuurs, G.-J. (1996).Significance of wood products in forest sector carbon balances. In: Forest ecosystems, forest management and the global carbon cycle, eds M.J. Apps and D.T. Price. NATO ASI Series I. Springer-Verlag, Berlin



## SEMESTER – VII

### BIOSTATISTICS

CR: 4 + 2

Definition and application of statistics, types and source of data, classification and tabulation of data, frequency distribution, graphical representation of data, (Bar diagram, pie chart, histogram, frequency polygon) measures of central tendency ( mean, median, mode) measures of Dispersion ( range, standard deviation, Mean deviation, Quartile deviation, variance, coefficient of variation), Probability, Test of signification: basic concepts,( Z- Test, X<sup>2</sup>-Test, t-Test, F-test,), regression, Correlation : (scatter diagram, correlation co-efficient, its properties).

### PRACTICAL

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

### Suggested Readings:

1. Kenneth N.Berk(1998). Introductory Statistics.www.amazon.com
2. Arora P N (2003) Biostatistics.Himalayan publishers.
3. Marcello Pagano and Kimberlee Gauvreau (2008) Principles of Biostatistics.Jhon and Wiley sons ltd.