

COURSE SYLLABUS
FOR
Ph. D FORESTRY & ENVIRONMENTAL SCIENCES
(w.e.f. Academic Session: 2022-23)



“SCHOOL OF NATURAL RESOURCES”

DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES
GURU GHASIDAS VISHWAVIDYALAYA BILASPUR-495009, CHHATTISGARH
(A Central University established by the Central University Act.2009 No. 25 of 2009)

3/7/2023

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B. M. Ghosh

Course Structure of Ph.D. Program in Forestry and Environmental Sciences

Paper	CODE	Title of the Paper	Marks	Credit	Hours/Week
Paper I	FODAMT1	Research Methodology	100	04	04
Paper II	FODATT1	Forest Ecosystem Management	100	04	04
Paper III	FODAMTT2	Forest Measurements and Tree Improvement	100	04	04
	FODASS1	Seminar	-	Qualified/ Not qualified	-
		Total	300	12	12

Programme Outcome:

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

PO 2: Research approach: The scholars will identify the forest and environment related issues and investigate the possible solution through research, field trial, experimental designs, laboratory based research, corroboration with industrial and research institutes.

PO 3: Practical application: The scholars will implement the theoretical knowledge related to the subject into real life and experimental form. Real life problem solving approaches will be the outcome of research.

PO4: Problem investigation and analysis: The scholars will have the competence to investigate, and possess analytical skills to identify, formulate and solve real time Forestry and Environmental issues and provide a cutting edge solution.

PO5: Society: The scholars will apply the knowledge of Forestry to assess the resources for the benefits and wellbeing of forest dwellers and society.

PO6: On site field trial: The scholars will regularly visit field for their experimental research and experiential learning.

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PO7: Ethics: The scholars will apply ethical principles and commit to professional ethics, responsibilities and norms of the forestry and environment protection, and conservation practice.

PO8: Team work: The scholars will function effectively as an individual member or as a leader in diverse teams and multidisciplinary activities

PO9: Communication: The scholars will be able to communicate effectively by presentations and writing reports of the activities related to forestry

PO10: Management: The scholars will be able to manage the forest resources for mitigating climate change and sustainable future.

PO11: Life-long learning: The scholars will be engaged in independent lifelong learning in the broadest context of forestry operation and management.

Program Specific Outcomes:

PSO1: Scholars will develop strong competencies in research in the field of Forestry and Environmental Sciences and its application in forestry and environmental sciences.

PSO2: Scholars will develop experimental design, forest survey & mapping, forest management planning, field investigation and environmental sustainability using conventional as well as recent tools and technologies.

PSO3: To prepare the scholars for employment in Forestry, Environmental Sciences and allied sectors and to meet the workforce demand of government and industries.

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Syllabus

Ph.D. Course Work of Forestry and Environmental Sciences

Paper-I Research methodology

Course Objectives:

1. To learn about the basic concepts of research, biostatistics, experimental designs for forest-based experiments.
2. To develop understanding on the hypothesis, Literature review, data handling and analysis, tabulation and graphical representation.
3. To be aware of the ethical issues and gain expertise on the scientific writing including reports, drafts etc.

Unit-I

- Meaning, Concept, Nature, Steps, Types and Characteristics of research. Qualitative and quantitative methods of research
- Research proposal and its elements, Formulation of research problem-criteria of sources and definition, Development and characteristics of objectives. Development of hypotheses and applications.

Unit-II

- Concept of survey, inventory making, sampling methods. Tools of data collections, experimental designs, their types, attributes, data entry, tabulation, statistical analysis and interpretation.
- Working principles and analytical instruments used in forestry and environmental sciences research

Unit-III

- Ethical issue, ethical committees, commercialization, copy right, royalty, Intellectual property rights and patent law, reproduction of published materials, Plagiarism, Citation and Acknowledgement- Reproducibility and accountability.

Unit-IV

- Results and conclusions writing of research, preparation of manuscripts for publication of research paper, presenting a paper in scientific Seminar, Thesis writing. Structure and components of research report, Types of research report: Research paper, thesis, Research project reports. Pictures and graphs citation style, writing a review paper, Bibliography. Citation index, Use of AI in forestry research

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Suggested Readings

1. C.R. Kothari, Gaurav Gar (2019). Research Methodology. New Age International Publishers; Fourth edition
2. Shanti Bhushan Mishra, Shashi Alok. (2011) Handbook of Research Methodology- A compendium for Scholars & Researchers. Educreation Publishing
3. Arora P N (2003) Biostatistics. Himalayan publishers.
4. Arora, P.N. and P.K. Malhan (2016), Biostatistics, Himalaya Publishing House.
5. K.Balaji, A.V.S. Raghavaiah, K.N. Jayaveera (2012), Biostatistics, I.K. International Publishing House Pvt. Ltd. New Delhi.
6. Partha Pratim Ray (2022). A Guide to Research and Publication Ethics A Text Book As per UGC Guidelines for UG, PG, MPhil and PhD. New Delhi Publishers
7. Debabrata Basu, Samarpan Chakraborty, Aditya Sinha. (2021). Research and Publication Ethics: A Textbook. Concept Publishing Company Pvt. Ltd.; First Edition
8. Marija J. Norušis. (2011). IBM SPSS Statistics 19 Guide to Data Analysis. Pearson Prentice Hall
9. Brian S. Everitt, Sabine Landau (2003). A Handbook of Statistical Analyses Using SPSS. Chapman & Hall/CRC; 1st edition
10. Peter Dalgaard. (2008). Introductory Statistics with R. Springer

Course Outcome:

1. Students will have an idea on research and be able to layout experimental designs.
2. Develop competency for data handling analysis, graphical designing and test of experimental data statistically.
3. Students will be expertise on scientific writing skills and draft reports.

CO	PO											PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	3	3	2	2	3	3	3	2
CO2	3	3	2	3	2	2	3	3	2	2	3	3	3	3
CO3	3	3	2	3	3	3	2	3	2	2	3	3	3	3

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

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Paper – II Forest Ecosystem Management

Course Objectives:

1. To enhance knowledge on Forestry systems and tools for forest management.
2. To gain knowledge on various forest services including NTFPs and conservation methods of wildlife.
3. To know about the Climate Change impact on forestry and conduct of EIA activity.

Unit-I

- Indian and World Forestry systems, Forest types of Chhattisgarh, ISFR reports, Biodiversity assessment and conservation techniques, Water and soil conservation strategies.
- Criteria and Indicators of sustainable forest management, community forest management. Challenges, opportunities and constraints in Forest management, Rapid Rural Appraisal and Participatory Rural Appraisal.

Unit-II

- Site Quality and Ecosystem Evaluation, Biomass estimation, Biogeochemical cycles and nutrient dynamics, Soil microbial dynamics, Soil enzymes activities, Ecosystem restoration.
- Non-Timber Forest Products, value-added products and marketing channel, Role of NTFPs and sustainable use. Production Technology of important medicinal and aromatic plants.

Unit-III

- Forestry interventions- Plantation forestry, Industrial forestry, Urban forestry, Social forestry, Forested watersheds, Recent advances in Agroforestry research.
- Conservation Forestry- National Parks, Biosphere reserves, Sanctuaries, Arboretum, Wildlife census techniques, Wildlife corridor and habitat development, Human-Wildlife conflicts.

Unit -IV

- Carbon Forestry, Climate Change and Global Warming, Carbon Budget, Carbon Trading, Climate Change Vulnerability assessment, Carbon stock assessment in soil and vegetation, International negotiation and treaties on Climate Change.
- Environmental monitoring, EIA guidelines, Techniques, formulation and process of EIA
- Water quality index, Air quality index, Pollutions effects on Environment and Forest health.

Suggested Readings

1. Adrien Djomo (2023). Climate Change Mitigation - Sustainable Management of Forest Ecosystems and Natural Resources

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2. Alain Rostand Lieunang Letche (2021). Protocol For Measuring, Monitoring And Sustainable Management of Carbon Stocks in Tropical Forests. Our Knowledge Publishing
3. Ashok Malik (2008) Dynamics of forest ecosystems. Today and Tomorrow publishers, New Delhi.
4. John L. Innes, Anna V. Tikina (2017). Sustainable Forest Management From Concept to Practice
5. J.S. Singh, S. P. Singh., S. R. Gupta (2014). Ecology, Environmental Science and Conservation. S. Chand publication.
6. Krebs, C.J. (2016), Ecology, Pearson Education Inc.
7. T.D. Biswas and G. Narayanasamy (1996). Soil Management in Relation to Land Degradation and Environment. Bull. Indian Soc. Soil Sci.17, New Delhi.
8. J.W. Doran and A.J. Jones (1996). Methods of Assessing Soil Quality. Soil Science Society of America, Madison.
9. D.J. Greenland and I. Szabolcs (1994). Soil Resilience and Sustainable Land Use. CABI.
10. SP Rawat 2008 Non-Timber Forest Products of India Gen Tech Books New Delhi
11. Mehta T. 1981. A Handbook of Forest Utilization. Periodical Expert Book Agency.
12. Jeffers JNR. 1978. An Introduction to System Analysis with Ecological Application. Edward Arnold.
13. Mehta T (2012) A handbook of forest utilization. Today and Tomorrow publishers.
14. Taank P (2010) Forest product and their utilization. Today and Tomorrow publishers.
15. Jha LK. 1995. Advances in Agroforestry. APH Publ.
16. Nair PKR. 1993. An Introduction to Agroforestry. Kluwer.
17. Balakrishnan, M., (2016), Wildlife Ecology and Conservation, Scientific Publication.
18. Dwivedi A P (2009). Managing wildlife of India. International Book Distributors, Dehradun, India.
19. Karanth K. Ullas (2017), Wildlife Population, Nataraj Publications.
20. Rajesh Gopal (1992). Fundamentals of wildlife management. Justice Home, Allahabad, India.

Course Outcome:

1. Scholars will acquire the knowledge about World Forestry systems and the carry out forest management strategies.
2. Scholars will gain knowledge related to various services obtained from the forest, NTFPS, and conservation forestry.
3. Scholars will be able to combat climate change impact through research in forestry.
4. They will also be well acquainted with the processes of carrying out EIA activities.

CO	PO											PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3	2	3	3	3	2	3	3	3
CO2	3	2	3	3	2	3	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

Paper - III Forest Measurements and Tree Improvement

Course Objectives:

1. To develop knowledge about silviculture techniques and forest biometry including remote sensing and GIS applications.
2. To gain knowledge on several aspects of tree biology, wood science and the tools for tree improvement.
3. To be aware of the Forest health and methods for forest regeneration and management

Unit- I

- Forest Biometry and forest measurement.
- Recent techniques of Silviculture management of Forest, Plantation productivity analysis, response of plantation to irrigation, management strategies for enhancing plantation productivity.
- RS components, Electromagnetic spectrum, GIS software, mapping of vegetation, land use and land cover, and water bodies through RS & GIS, Role of GPS in forest.

Unit- II

- Seed quality and viability testing, Provenance trials, Seed production areas, Seed Orchard management, Assessment of genetic diversity in forest trees, Techniques of Tissue culture and Tree improvement, Reproductive biology of forest trees.
- Molecular markers and tools used for tree improvement, Concepts of Genomics, Documentation and evaluation of Forests Genetic Resources, In situ and Ex situ conservation of genetic resources.

Unit-III

- Carbon fixation, water absorption and transport, ascent of sap, nitrogen fixation, water stress and mineral stress physiology.
- Wood formation, Properties of wood, engineered wood, Wood certification, Smart furniture concept, Recent advances in wood preservation.

Unit- IV

- Forest pests and Diseases, Disease outbreaks in forest trees, forest fire, integrated pest management, bio-control methods, Forest health and Climate Change.
- Nursery practices of some major tree species, Assisted Natural Regeneration, Quantification of Forest regeneration, Biofertilizer and Microbial technology.

Suggested Readings

1. Dwivedi AP. 1993. Forestry in India. Surya Publ.
2. Khanna LS. 1996. Principle and Practice of Silviculture. International Book Distributors.
3. L.F. Janssen (2000). Principles of Remote Sensing. ITC. Edl. Text Book Series II. The Netherlands
4. Rolf A.de By. (2000). Principles of Geographical Information Systems. ITC. Edl. Text Book Series I. The Netherlands
5. M.K. Sharma (1986). Remote Sensing and Forest Surveys, International Book Distributors, Dehra Dun.
6. B. Bhatta (2008). Remote Sensing and GIS. Oxford Publications.
7. Chaturvedi AN & Khanna LS. 1994. *Forest Mensuration*. International Book Distributor.
8. Ram Prakash 1986. Forest Management. International Book Distributors.
9. Kumar V. 1999. Nursery and Plantation Practices.in Forestry. Scientific Publ.
10. Barnett J, Baker P & James B. 1991. Regeneration Methods. USDA. Proceedings. Reprint. Boyd RJ.
11. FAO. 1985. Forest Tree Improvement, FAO Publi.
12. P.K. Agrawaland M Dadlani (1987). Techniques in seed science and technology, South Asian Publishers , Delhi
13. Faulkner R. 1975. Seed Orchard Forestry. Commission Bull. No.34.
14. Khosla PK. 1981. Advances in Forest Genetics. Ambika Publ., New Delhi.
15. Mandal AK & Gibson GL. (Eds.). 1997. Forest Genetics and Tree Breeding. CBS.
16. Zobel BJ & Talbert J. 1984. Applied Forest Tree Improvement. John Wiley & Sons.
17. Negi SS. 2007. Wood Sciences and Technology. International Book Distr.
18. Terry Porter (2006). Wood Identification and Use. Guide Master Craftman publications.
19. S. Hill Callum (2006). Wood modification: Chemical thermal and other process. Today and Tomorrow publishers.
20. Ram Prakash, Chaudhari DC & Negi SS. 1998. Plantation and Nursery Techniques of Forest Trees. International Book Distributors.
21. Bakshi, B.K. Forest Pathology. (1976) Principles and Practices in Forestry. Controller of Publications, New Delhi.
22. Beeson, C.F.C. (1941) Forest Insects of India, The Ecology and Control of the diseases. International book distributors, Dehra Dun.
23. Paul D Menan (2003) Tree and disease concept. Prentice hall Inc.

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Course Outcome:

1. The students will know about silviculture techniques and forest biometry including remote sensing and GIS applications in forestry.
2. The students will be able to understand the recent advancement on tree biology, wood science and the tools for tree improvement.
3. The students will be able to identify the disease and pest in Forest including the methods for forest regeneration and management.

CO	PO											PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO2	3	2	3	3	3	2	3	2	3	2	2	3	3	3
CO3	3	3	2	2	3	3	3	3	3	3	3	3	3	2

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

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