

PhD syllabus

DEPARTMENT OF FOREST SCIENCE
COURSE STRUCTURE FOR PhD PROGRAMME
YEAR: 2019
TOTAL CREDIT: 15, TOTAL MARKS: 300

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SEMESTER	COURSE NO.	COURSE TITLE	CREDIT	MARKS
I	FSP-101	Research Methodology	5	100
	OPTIONAL PAPERS (CANDIDATES CAN SELECT ANY ONE PAPER)			
	FSP-102. A	Wood Science & Technology	5	100
	FSP-102. B	Forest Bio-energy		
	FSP-102. C	Medicinal and Aromatic Plants		
	FSP-103	Literature Review & Report Writing	5	100
			15	300

[FSP-101]: RESEARCH METHODOLOGY

Unit-1: Identification of problems and formulation research questions/hypothesis: hypotheses testing: Null hypothesis and Alternative hypothesis, research design: concept and importance of research – features of a good research design, exploratory research design; concept, types and uses, descriptive research designs: concept, types and uses. Experimental design, concept of independent and dependent variables, qualitative and quantitative research: concept of measurement, causality, generalization, replication.

Unit-2: Sampling: Concept of statistical population, sampling frame, sampling error, sample size, non response, characteristics of a good sample. Probability sample – simple random sample, systematic sample, stratified random sample and multi-stage sampling. Determining size of the sample – practical considerations in sampling and sample size, data analysis: data preparation; univariate analysis (frequency tables, bar charts, pie charts, percentages), bivariate analysis; cross tabulations and Chi-square test including testing hypothesis of association.

Unit-3: Interpretation of data and paper writing, general layout of a research paper, research paper, review paper and short communications, Preparation of synopsis: Selection and generation of research problems, stating objectives of research study, literature survey, hypothesis formulation, work plan. Writing project proposal, preparation of thesis/dissertations/research project report and development of scientific articles for publication, SCI and introduction to predatory journals, journals in Forestry & Plant Sciences, impact factor, eigen factor, h-index, i-10 index, cite score, when and where to publish, ethical issues related to publishing, conflict of interest, plagiarism and self-plagiarism, use of encyclopedias, research guides, handbook etc.,

Unit-4: Use of tools / techniques for research: methods to search required information effectively, Reference Management software like Zotero/Mendeley, software for paper formatting like MS Office, software for detection of plagiarism and similarity index

SUGGESTED READING

1. Nicholas, W. Research methods: the basics, 2nd edition
2. Kothari, C. R. Research methodology – methods and techniques

3. Flick, U. Introducing research methodology: A beginner's guide to doing a research project
4. Denzin, Norman K and Lincon, Yvonna S. The SAGE handbook of qualitative research, 5th edition

[FSP-102-A]: WOOD SCIENCE & TECHNOLOGY

Unit-1: Ultra-structure and composition of softwoods and hardwoods, chemical composition of wood, cell wall constituents; cellulose, hemicelluloses, lignin and pectic substances. Physical properties and shrinkage of wood, elastic, strength, and vibration properties of wood, mechanical properties of wood, calorific value of wood, reaction wood, fire performance characteristics of wood, defects in wood.

Unit-2: Need and importance of wood seasoning; general principles of seasoning, methods of wood seasoning, air and kiln seasoning, solar dehumidification, steam heated and electrical kilns. Wood preservation; concept of durability and factors affecting durability of wood, wood preservatives and their properties, wood preservation processes, composite wood and improved wood, bioactive wood polymer composites

Unit-3: Uses of wood, potential requirement of industrial wood, major wood based industries; match industry, paper and pulp industry, pencil industry, plywood industry, packing case industry, furniture industry, sports good industry etc. Status of supply of raw materials to wood based industries. Commercial plantations for industrial wood production – present status and future prospects

Unit-4: Production of chemicals and fuels from forest biomass with special reference to wood as a chemical and bioenergy feedstock, wood as a feedstock for futuristic biorefineries, fermentation of lingo-cellulosic woody biomass for bio-alcohol production, pyrolysis of wood, gasification of woody biomass, important wood extractives, wood plastics, wood refinery techniques, chemicals produced as by-product in pulp industry, destructive distillation of wood, future of the wood chemical industry.

SUGGESTED READING

1. Mehta T. 1981. A Handbook of Forest Utilization. Periodical Expert Book Agency.
2. Rao, KR & Junaja KBS. 1992. Field Identification of 50 Important Timbers of India. ICFRE, Dehradun.
3. Sharma LC. 1977. Development of Forests and Forest-based Industries. Bishen Singh Mahender Pal Singh, Dehradun.
4. Trotter H. 1982. Manual of Indian Forest Utilization. FRI & College, Dehradun.
5. Wadoo MS. 1992. Utilization of Forest Resources. IDRIS Publications

[FSP-102-B]: FOREST BIOENERGY

Unit-1: New and renewable energy sources, concept of biomass and bioenergy, bioenergy in comparison to other domains of energy, biomass formation, global bioenergy scenario, classification of biomass, characterization of biomass - ultimate and proximate analysis, biochemical constituents-cellulose, hemicelluloses, lignin and pectin, biomass estimation and techniques for biomass resource assessment, use of remote sensing and GIS in forest assessment, general introduction to the bio-based economy concept.

Unit-2: Thermo-chemical conversion: Direct combustion, incineration-incinerator design, advantages and disadvantages of incineration, pyrolysis - history, significance, type, factors affecting pyrolysis, properties of pyrolytic bio-oil, biochar as a carbon sequestering agent, gasification and Fischer-Tropsch's synthesis, thermo-chemical liquefaction. Biochemical conversion: Use of micro-organisms, enzymes and catalysts for fuels and chemical production, transesterification (acidic, alkali and enzyme catalyzed) and biodiesel production, technical properties of biodiesel, bioconversion of substrates into alcohol-methanol and ethanol production, organic acids, solvents, amino acids and antibiotics

Unit-3: General Introduction to the biorefinery concept, biorefinery Vs chemical refinery, platform biorefineries, outline of an integrated biorefinery and the various (upstream and downstream) unit operations involved, microbial biorefineries Vs plant based biorefineries, algae as vessels for photosynthetic biorefineries, life cycle assessment in the realm of biorefining,

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global scope of bioenergy, cellulosic biorefinery for bio-ethanol production, futuristic biorefineries.

Unit-4: Criteria for evaluation of fuelwood species for energy production, consumption trends of fuelwood in India, general introduction to energy forestry, energy plantations with special emphasis on short rotation forestry and short rotation coppice, energy plantations and waste land reclamation, energy plantations and power generation, SWOT analysis pertaining to energy forestry, exemplary trials in energy forestry, scope of energy forestry with special reference to the state of Nagaland

SUGGESTED READING

1. Dahiya, A, 2014. Biomass to biofuels, 1st edition
2. Kellomaki, S, Kilpelainen, A and Alam, A. 2013. Forest Bioenergy production: Management, carbon sequestration and Adaptation
3. Thiffault, Smith, Junginger and Berndes, 2016. Mobilisation of Forest Bioenergy in the boreal and temperate biomes

[FSP-102-C]: MEDICINAL AND AROMATIC PLANTS

Unit-: History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants (MAPs) in India. Introduction to the Ethnobotany concept, MAP: importance, origin, distribution, area, production, climatic, soil requirements, nutritional and water requirements. Good agricultural practices (GAP) for MAPs. Endangered MAPs and their conservation status in the Indian context with particular focus on the state of Nagaland

Unit-2: Primary and secondary plant metabolites, types of secondary metabolites in plants- flavonoids, terpenoids, alkaloids- chemical structure, extraction, production and applications, *in vitro* production of secondary metabolites by tissue culture approach, applications of secondary metabolites, therapeutic uses of phytoconstituents such as gums, anthraquinones, steroidal and triterpenoidal glycosides, phenolic compounds, lipids etc.

Unit-3: Therapeutic and pharmaceutical use of major medicinal plants; pepper, cardamom, clove, ginger, turmeric, betelvine, periwinkle, Rauvolfia, Dioscorea, isabgol, myrobalans (aonla,

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harde, baheda), Ammi majus, belladonna, Cinchona, pyrethrum and other species relevant to local conditions. Therapeutic and pharmaceutical use of aromatic plants: Citronella grass, khus grass, sweet flag (bach), lavender, geranium, patchouli, bursera, mentha, muskdana (musk mallow), ocimum and other species relevant to the local conditions.

Unit-4: Plant protection, harvesting and processing of important medicinal and aromatic plants. Post harvest processing-drying, grading and storage. Procedures involved in the extraction of phtoconstituents/phytochemicals from medicinal plants. Chromatographic separation procedures in phytochemistry Essential oils: Extraction and production methods of natural essential oils. Chemical composition of essential oils, bioactivity (antibacterial, antifungal, anti-tumor, anti-oxidant etc.) of various essential oils and their storage. General applications of essential oils with special reference to aromatherapy

SUGGESTED READING

1. Alikhan. I and Khanum .A, 2008. Role of Biotechnology in Medicinal and Aromatic Plants. UKAZ Publications
2. Gupta AK, Tandon N & Sharma M. 2008. Quality Standards of Indian Medicinal Plants, ICMR
3. Johnson CB and Franz C, 2005. Breeding Research on Aromatic and Medicinal Plants. International Book Distributors
4. Sharma R, 2004. Agro-techniques of Medicinal Plants. Daya Publications

[FSP-103]: LITERATURE REVIEW & REPORT WRITING