

COURSE CATALOGUE & SYLLABUS

FOR

B.Sc. (FORESTRY) PROGRAMME



SCHOOL OF FORESTRY & ENVIRONMENT

SHIATS - DEEMED UNIVERSITY,

ALLAHABAD - 211007

UTTAR PRADESH

B.Sc. (FORESTRY)

SEMESTER - I

Course Code	Title of the course	Credits
GPT-301	Moral & Value Education	2 (2+0)
LNG-304	Professional Communication and Technical Writing	3 (3+0)
HSBS-302	Human Development, Professional Ethics & Personality Development	2 (2+0)
SVC-301	Principles and practices of Silviculture	3 (2+1)
TBR-301	Forest Ecology, Biodiversity & Conservation	2 (1+1)
TBR-302	Cytology & Genetics	2 (1+1)
CHEM-417	General Biochemistry	3 (2+1)
MAS-303	Elementary Mathematics (Deficiency-Bio)	3 (3+0)
AGF-301	Introduction to Tree Science (Deficiency-Maths)	3 (3+0)
COMP-302	Computer Application	2 (1+1)
	Physical Education	NC
	Total Credits	22 (17+5)

SEMESTER - II

Course Code	Title of the course	Credits
SVC-302	Forest Mensuration	3 (2+1)
ENV-415	Environmental Studies I	2 (1+1)
SAC-406	Introduction to Forest Soil Science & Geology	2 (1+1)
FBL-301	Dendrology	2 (1+1)
ECON-507	Principles of Forest Economics	2 (2+0)
CE-310	Surveying and Leveling	3 (2+1)
EXT-304	Fundamentals of Extension Education & Community Development	2 (1+1)
TBR-303	Tree Seed Technology	2 (1+1)
AFG -302	Agrometeorology	2 (1+1)
	Total Credits	20 (12+8)

SEMESTER - III

Course Code	Title of the course	Credits
SVC-401	Forest Management & Working Plan	3 (2+1)
SVC-402	Silvicultural Systems	2 (2+0)
FBL-401	Forest Entomology and Pest management	3 (2+1)
LPM-425	Livestock Management	2 (1+1)
SAC-407	Fertility of Forest Soils & Nutrient Management	3 (2+1)
MBMT-414	General & Forest Microbiology	3 (2+1)
AGF-401	Medicinal and Aromatic Plants	2 (1+1)
FBL-402	Wood Anatomy	2 (1+1)
.....	NSS/NCC	NC
	Total Credits	20 (13+7)

SEMESTER - IV

Course Code	Title of the course	Credits
ENV-416	Environmental Studies II	2 (2+0)
AGF-402	Agroforestry & Social Forestry	2 (1+1)
SVC-403	Silviculture of Indian Trees	3 (2+1)
FBL-403	Fundamentals of Wildlife & Forest Tribes	3 (2+1)
TBR-401	Wood Science & Technology	3 (2+1)
SAC-508	Forest Soil Survey, Land Use & Remote Sensing	3 (2+1)
SVC-404	Nursery Management and Seedling Production	2 (1+1)
MAS-417	Statistical Methods & Designs of Experiments	3 (2+1)
	Total Credits	21 (14+7)

SEMESTER - V

Course Code	Title of the course	Credits
AGF-501	Forest Utilization - I (Timber & Forest Products)	3 (2+1)
FBL-501	Wildlife Management & Biosphere	3 (2+1)
TBR-501	Tree Improvement	3 (2+1)
TBR-502	Wood Seasoning and Preservation	2 (1+1)
FBL-502	Tree Physiology	2 (1+1)
FBL-503	Forest Pathology & Disease Management	3 (2+1)
AGF-500	Commercial Forestry	2 (1+1)
SVC-501	Logging & Ergonomics	2 (1+1)
	Total Credits	20 (12+8)

SEMESTER - VI

Course Code	Title of the course	Credits
AGF-502	Forest Utilization – II (Non-Timber Forest Products)	3 (2+1)
SVC-502	Forest Policy and legislation	1 (1+0)
SVC-503	Plantation Forestry	2 (1+1)
TBR-503	Forest Biotechnology	3 (2+1)
ECON-508	Forest Production Economics and Marketing	3 (2+1)
SAC-610	Forest soils and Watershed Management	3 (2+1)
HORT-403	Fruit Production & Plantation crops	3 (2+1)
AGF-503	Rangeland Management	3 (2+1)
	Total Credits	21 (14+7)

SEMESTER – VII

(Experimental Learning/Hands on Training)

Five Supplementary Subjects (**Any one as an Optional**)

Course Code	Title	Credits
SAC-600	Soil Water Management	20 (0+20)
ENV-600	Climate Change	20 (0+20)
ENV-620	Bio-Energy	20 (0+20)
AGF-600	Eco-Tourism	20 (0+20)
ENV-630	Environmental Impact Assessment	20 (0+20)
	Total Credits	20 (0+20)

SEMESTER – VIII

(Multidisciplinary Courses / Vocational Training)

Course Code	Title	Credits
SVC-699	Forest Project /Industrial Placement / Institutional Attachment	10 (0+10)
FBL-500	Study Tour	6 (0+6)
AGF-698	Forestry Work Experience	4 (0+4)
	Total Credits	20 (0+20)

Total Credits (Semester I to VI) : 124

(Semester VII & VIII) : 40

: 164

SEMESTER – I

CSE-501

MORAL AND VALUE EDUCATION

Cr. 2(2+0)

Theory:

My country and my people, the many Indians, Being and becoming an Indian, Nationalism and Internationalism. Some life issues – Love, Sex and marriage, men and money- value of time, meaning of work, human communication, human suffering, addiction, ecology, women's issues. Understanding one's neighbour. Neighbourhood groups : their structure and functions, patterns of social interaction of group dynamics. Preparation for career, Choice of vocation, motivation for study and research, the present Educational system : curriculum and syllabus, teaching methods, examination and work experience. Definition of value education, moral and ethics, laws and morale based on Ten Commandments and two great commandments. Discovery of self, self-awareness growth of intellect – man's spiritual nature emotions, will. Respect the rights of life, property, truth reputation. Sin, origin of sin, manifestation of sin, the results of sin, The remedy of sin, sin as an act, sin as a state, sin as a nature. Conscience – as defined in Oxford Dictionary and Winston Dictionary, types of consciousness (such as evil, convicted, purged, pure, weak, good, void of offence.)

Theory

Content	Lecture
• My country and my people, the many Indians	2
• Being and becoming an Indian, Nationalism and Internationalism.	3
• Some life issues – Love, Sex and marriage, men and money- value of time,	2
• Meaning of work, human communication,	1
• Human suffering, addiction, ecology, women's issues.	2
• Understanding one's neighbour. Neighbourhood groups : their structure and functions.	2
• Patterns of social interaction of group dynamics.	2
• Preparation for career, Choice of vocation,	2
• Motivation for study and research.	2
• The present Educational system : curriculum and syllabus, teaching methods, examination and work experience.	3
• Definition of value education, moral and ethics, laws and morale based on Ten Commandments and two great commandments.	3
• Discovery of self, self-awareness growth of intellect – man's spiritual nature emotions, will.	2
• Respect the rights of life, property, truth reputation.	2
• Sin, origin of sin, manifestation of sin, the results of sin, The remedy of sin, sin as an act, sin as a state, sin as a nature.	3
• Conscience – as defined in Oxford Dictionary and Winston Dictionary, types of consciousness (such as evil, convicted, purged, pure, weak, good, void of offence).	3

References

1. Adwani, L.K., My Country and my people.
2. NCERT, Moral Science
3. Chand, S. Moral Science, Chand Publication, New Delhi.

LNG-304 PROFESSIONAL COMMUNICATION AND TECHNICAL WRITING
Cr. 3(3+0)

Theory

Meaning of communication and Technology-Communication process. Elements and models. Types of communications- Communication in relation to diffusion and adoption. Audio- visual aids, their use and effectiveness. Extension approach: Individual, Group, Mass, Indirect. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Theory

Content	Lecture
• Meaning of communication and Technology-Communication process.	3
• Elements and models. Types of communications- Communication in relation to diffusion and adoption.	6
• Audio- visual aids, their use and effectiveness.	4
• Extension approach: Individual, Group, Mass, Indirect.	5
• Communication Skills: Structural and functional grammar; meaning and process of communication,	6
• Verbal and non-verbal communication; listening and note taking, writing skills.	6
• Oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.	6
• Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting.	6
• Individual and group presentations, impromptu presentation, public speaking.	6
• Group discussion. Organizing seminars and conferences.	3

References

1. NCERT, English Grammar
2. Wren & Martin, English Grammer

SVC-301 PRINCIPLES AND PRACTICES OF SILVICULTURE Cr. 3(2+1)

Definition of forest and forestry. Classification of forest and forestry, branches of forestry and their relationships. Definition, objectives and scope of Silviculture. Status of forests in India and their role. History of forestry development in India. Site factors - climatic, edaphic, physiographic, biotic and their interactions. Classification of climatic factors. Role played by light, temperature, rainfall, snow, wind, humidity and evapo-transpiration in relation to forest vegetation. Bioclimate and micro climate effects. Edaphic factors - influence of biological agencies, parent rock, topography on the soil formation. Soil profile -physical and chemical properties, mineral nutrient and their role, soil moisture and its influence on forest production. Physiographic factors - influence of altitude, latitude, aspect and lope on vegetation. Biotic factors - influence of plants, insects, wild animals, man and domestic animals on vegetation. Impacts of controlled burning and grazing. Influence of forests on environment. Trees and their distinguishing features. Growth and development. Forest reproduction - flowering, fruiting and seeding behaviour. Natural, artificial and mixed regeneration. Natural regeneration - seed production, seed dispersal, germination and establishment. Requirement for natural regeneration. Dieback in seedling with examples. Plant succession, competition and tolerance. Forest types of India and their distribution.

Practical:

Acquaintance with various technical terms. Visits to different forest areas/types. Study of forest composition. Recording the observations on shoot development, growth rings, crown development, leafing, flowering and fruiting in a few selected tree species. Study of site factors like climatic, edaphic, physiographic and biotic. Study of forest succession. Study of the afforestation and reforestation success.

Theory

Content	Lecture
• Definition of forest and forestry.	1
• Classification of forest and forestry, branches of forestry and their relationships.	2
• Definition, objectives and scope of Silviculture.	2
• Status of forests in India and their role.	2
• History of forestry development in India.	2
• Site factors - climatic, edaphic, physiographic, biotic and their interactions.	2
• Classification of climatic factors. Role played by light, temperature, rainfall, snow, wind, humidity and evapo-transpiration in relation to forest vegetation.	2
• Bioclimate and micro climate effects.	2
• Edaphic factors - influence of biological agencies, parent rock, topography on the soil formation.	2
• Soil profile -physical and chemical properties, mineral nutrient and their role, soil moisture and its influence on forest production.	2
• Physiographic factors - influence of altitude, latitude, aspect and lope on vegetation.	2

- Biotic factors - influence of plants, insects, wild animals, man and domestic animals on vegetation. 1
- Impacts of controlled burning and grazing. 3
- Influence of forests on environment. 1
- Trees and their distinguishing features. 1
- Growth and development. 1
- Forest reproduction - flowering, fruiting and seeding behaviour. 1
- Natural, artificial and mixed regeneration. Natural regeneration - seed production, seed dispersal, germination and establishment. 1
- Requirement for natural regeneration. 1
- Dieback in seedling with examples. 1
- Plant succession, competition and tolerance. 1
- Forest types of India and their distribution. 1

Practical

Content	Lecture
• Acquaintance with various technical terms.	2
• Visits to different forest areas/types.	2
• Study of forest composition.	2
• Recording the observations on shoot development, growth rings, crown development, leafing, flowering and fruiting in a few selected tree species.	4
• Study of site factors like climatic, edaphic, physiographic and biotic.	2
• Study of forest succession.	2
• Study of the afforestation and reforestation success.	2

References

1. Khanna, L. S. 1984. Principles and Practice of Silviculture, Khanna Bhandu, Dehra Dun. P. 476.
2. Ram Prakash and L.S. Khanna. 1991. Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun. 298p.
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, 420p.
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. David M. Smith. 1989. "The Practice of silviculture". EBD Educational Pvt. Ltd. Dehradun, India.

TBR-301 FOREST ECOLOGY, BIODIVERSITY & CONSERVATION Cr. 2(1+1)

Theory:

Historical development of ecology as a science. Concept of levels of biological organization. Ecosystem – classification and distribution. Forest environment- Major abiotic and biotic components and their interaction, Nutrient cycling, trophic levels, food webs, ecological pyramids and energy flow. Population ecology - definition, population dynamics and carrying capacity, preparation of life table and its importance in forest management. Community ecology – Species interaction, Ecological succession, terminology, basic concepts, climax vegetation types, Methods to study effects of forest management on succession. Island Biogeography. Autecology of important tree species. Biodiversity and conservation – definition, levels of study, distribution of diversity in life forms, hotspots of biodiversity, measurement of diversity and diversity indices. Principles of conservation biology, Ex situ and In situ methods of conservation, Genetical and evolutionary principles in conservation. Biosphere concept. Conservation – efforts in India and worldwide.

Practical:

Estimating productivity of a site; Study of microclimate and forest soils; Study of ecological modifications of leaves; Effects of fire on forest ecosystem; Study of population dynamics using model systems; Preparation of life tables; Study of spatial dispersion among plants; Study of Forest composition; Niche analysis; Computation of diversity indices; Measurement of diversity of plants and insects in a near by forest; Study of succession in field and water bodies; Visit to different ecosystems.

Theory

Content	Lecture
• Historical development of ecology as a science.	1
• Concept of levels of biological organization.	1
• Ecosystem – classification and distribution.	1
• Forest environment- Major abiotic and biotic components and their interaction.	1
• Nutrient cycling, trophic levels, food webs, ecological pyramids and energy flow.	2
• Population ecology - definition, population dynamics and carrying capacity, preparation of life table and its importance in forest management.	2
• Community ecology – Species interaction, Ecological succession, terminology, basic concepts, climax vegetation types.	2
• Methods to study effects of forest management on succession.	1
• Island Biogeography. Autecology of important tree species.	1
• Biodiversity and conservation – definition, levels of study, distribution of diversity in life forms, hotspots of biodiversity, measurement of diversity and diversity indices.	2
• Principles of conservation biology, Ex situ and In situ methods of conservation.	1

- Genetical and evolutionary principles in conservation. 1
- Biosphere concept, Conservation – efforts in India and worldwide. 1

Practical

Content	Lecture
• Estimating productivity of a site.	3
• Study of microclimate and forest soils.	1
• Study of ecological modifications of leaves.	1
• Effects of fire on forest ecosystem; Study of population dynamics using model systems.	2
• Preparation of life tables; Study of spatial dispersion among plants.	2
• Study of Forest composition; Niche analysis.	1
• Computation of diversity indices.	1
• Measurement of diversity of plants and insects in a near by forest.	2
• Study of succession in field and water bodies.	2
• Visit to different ecosystems.	1

References

1. Mishra, R. 1968. Ecology Work Book Oxford and IBH Publishing Co, Calcutta, pp. 244.
2. Odum, E.P. 1983. Basic Ecology. Saunders College Publishing, Holt Saunders, Japan, 613.
3. Odum, E.P. Fundamentals of Ecology, Natraj Publisher, Dehradun
4. Arvind Kumar. Biodiversity and environment. Published by A.P.M. Publishing Corporation, New Delhi.
5. Global biodiversity status of the earth's living resources. Published by Crapman and Hall, 2-6 Boundary Row, London SE1 8HN. Compiled by World Conservation Monitoring Centre.
6. Kumar and Asija. Biodiversity – Principles and conservation. Published by Updesh Purohit for Agrobios, Jodhpur, India.
7. Singh, Vishwakarma. Forest environment and biodiversity. Daya Publishing House, Delhi.
8. Tewari, D.N. Biodiversity and forest genetic resources. Published by International Book Distributions, Dehra Dun.
9. Kovacs, M. 1995. Pollution Control and Conservation. Ellis Horwood Ltd., Chichester. 398p
10. Sinha, B.N. 1990. Eco-system Degradation in India. Ashish Publishing House, New Delhi.

TBR-301 CYTOLOGY AND GENETICS Cr. 2(1+1)

History of genetics and hypothesis-theories. Physical basis of heredity, cell reproduction –mitosis - meiosis and its significance. Gametogenesis and syngamy in plants. Mendel's principles of heredity, deviation from Mendelian inheritance, pleiotropy, threshold characters, co-dominance penance. Chromosome theory of inheritance, gene interaction: modification of monohybrid and dihybrid ratios. Multiple alleles, quantitative inheritance, linkage and crossing over, sex determination - theories, sex linked inheritance and characters. Cytoplasmic inheritance and maternal effects. Chemical basis of heredity: Structure of DNA and its replication. Evidences to prove DNA as genetic material. Mutation and its classification. Chromosomal aberrations: Changes in chromosome structure and number

Practical:

Study of fixatives and stains; Preparation of slides showing various stages of mitosis; Preparation of slides showing various stages of meiosis; Testing the viability and germination of pollen grains; Solving the problems on monohybrid and dihybrid crosses; Estimation of linkages/ chromosome mapping and Chi square tests.

Theory

Content	Lecture
• History of genetics and hypothesis-theories.	1
• Physical basis of heredity.	1
• Cell reproduction –mitosis - meiosis and its significance.	1
• Gametogenesis and syngamy in plants.	1
• Mendel's principles of heredity, deviation from Mendelian inheritance, pleiotropy. threshold characters, co-dominance penance.	1
• Chromosome theory of inheritance.	1
• Gene interaction: modification of monohybrid and dihybrid ratios.	1
• Multiple alleles, quantitative inheritance.	1
• Linkage and crossing over, sex determination	1
• Theories, sex linked inheritance and characters.	1
• Cytoplasmic inheritance and maternal effects.	1
• Chemical basis of heredity.	1
• Structure of DNA and its replication.	1
• Evidences to prove DNA as genetic material.	1
• Mutation and its classification.	1
• Chromosomal aberrations.	1
• Changes in chromosome structure and number	1

Practical

Content	Lecture
• Study of fixatives and stains.	3
• Preparation of slides showing various stages of mitosis	1
• Preparation of slides showing various stages of meiosis	1

- Testing the viability of pollen grains 2
- Testing the germination of pollen grains 2
- Solving the problems on monohybrid crosses 2
- Solving the problems on dihybrid crosses 2
- Estimation of linkages/ chromosome mapping 2
- Solving the problems on Chi square tests. 2

References

1. Zobel, B.J. and J. Talbert. 1984. Applied forest tree improvement. John Wiley & Sons, New York. p 505.
2. Bajaj, Y.P.S. 1986. Biotechnology in Agriculture and Forestry Springer Verlag, New York.
3. Bonga, J.M. and Durjan, J. 1987. Cell and Tissue culture in Forestry Vol. I & II. Martinus Nijost Publishers, Dordrecht.
4. Burley, J. and B.T. Styles. 1976. Tropical trees: variation breeding and conservation. Academic Press, London.
5. F.A.O. 1985. Forest tree improvement. FAO Publication, Rome, Italy. 270 p.
6. Hainer, R. 1996. Biotechnology in Forest Tree Improvement. (FAO Bulletin 1994). International Book Distributors. Dehra Dun.
7. Hayer, H. and D. Smith. 1975. Methods of plant breeding. McGraw Hill Book Co., London.
8. Khosla, P.K. 1982. Improvement of forest biomass. Pragati Press, Delhi. 472 p.
9. Mandal, A.K. and G.L. Gibson. (eds.). 1997. Forest genetics and tree breeding. CBS Publ. & Distr., New Delhi. 268 p.
10. Murphy, T.M. and Thompson, W.F. 1988. Molecular plant Development Prentice Hall, Engleward, cliffe, New Jersey.
11. Pochlman, J.M. 2002. Breeding field crops. AVI Publishing Co., New York.
12. Richards, A.J. 1986. Plant breeding systems. George Allen and Urwin, London.
13. Roy, Darbeshwar. 2000. Plant breeding: Analysis and exploitation of variation. Narosa Publishing House, New Delhi. p. 701.
14. Russel, G.E. 1988. Biotechnology of Higher Plants. Intercept publishers, Nimborne, Dorset.
15. White, T.M. and G.R. Hodges. 1989. Predicting breeding values with application in forest improvement. Kluwar Publishing, Netherlands.
16. Wright, J.W. 1976. Introduction to forest genetics. Academic Press, New York. 463 p.

CHEM-417 GENERAL BIOCHEMISTRY Cr. 3(2+1)

Theory:

Carbohydrates-occurrence and classification-structures of glucose, fructose, ribose, maltose,blactose, starch and cellulose, physical and chemical properties of carbohydrates-isomerism,boptical activity, reducing property, reaction with acids and alkalis-osazone formation. Lipidsclassification-bimportant fatty acids and triglycerides, essential fatty acids -rancidity of oils acids value, saponification value & iodine value -phospholipids-types and importance-plant pigments-structure and function of chlorophyll and carotenoids-sterols-basic structure. Protein - classification - functional and solubility - amino acids-classification and structureessential amino acids - properties of amino acids-colour reactions, amphoteric nature and isomerism-structure of proteins – primary, secondary, tertiary and quaternary properties and reactions of proteins. Enzymes-classification and mechanism of action-factors affecting enzyme action-cofactors and coenzymes - vitamins and mineral as coenzymes/cofactorscarbohydrate metabolism-glycolysis and TCA cycle-metabolism of lipids - lipases and phospholipases-fatty acid oxidation. Biosynthesis of fatty acids, protein metabolismproteolytic enzyme, electron transport chain-ATP formation, bioenergetics of glucose and fatty acids. Photosynthesis and nitrogen fixation structure and component of nucleic acids, replication, transcription and translation.

Practical:

Preparation of standard solutions and reagents – carbohydrates – qualitative reactions, estimation of starch, reducing and non-reducing sugars-reactions of proteins and amino acids-estimation of proteins by Lowry method – determination of acid value, saponification value, iodine number of vegetable oils-vitamins-estimation of ascorbic acidspaper and thin layer chromatography. Sterilization techniques; preparation of culture medium for establishment of explants of forestry plants, multiplication of shoots, induction of roots; meristem culturing; callus cultures, induction of organogenesis

Theory

Content	Lecture
• Carbohydrates-occurrence and classification-structures of glucose, fructose, ribose, maltose, blactose, starch and cellulose.	3
• Physical and chemical properties of carbohydrates-isomerism, boptical activity, reducing property, reaction with acids and alkalis-osazone formation.	3
• Lipidsclassification-bimportant fatty acids and triglycerides, essential fatty acids	3
• Rancidity of oils acids value, saponification value & iodine value .	2
• Phospholipids-types and importance.	1
• Plant pigments-structure and function of chlorophyll and carotenoids-sterols-basic structure.	3
• Protein - classification - functional and solubility.	1
• Amino acids-classification and structure essential amino acids	1
• Properties of amino acids-colour reactions, amphoteric nature and	3

- isomerism
- Structure of proteins – primary, secondary, tertiary and quaternary properties and reactions of proteins. 3
- Enzymes-classification and mechanism of action-factors affecting enzyme action-cofactors and coenzymes. 3
- Vitamins and mineral as coenzymes/cofactors-carbohydrate. 1
- Metabolism-glycolysis and TCA cycle-metabolism of lipids - lipases and phospholipases-fatty acid oxidation. 2
- Biosynthesis of fatty acids, protein metabolism proteolytic enzyme, electron transport chain. 2
- ATP formation, bioenergetics of glucose and fatty acids. 1
- Photosynthesis and nitrogen fixation structure and component of nucleic acids, replication, transcription and translation. 2

Practical

Content	Lecture
• Preparation of standard solutions and reagents – carbohydrates – qualitative reactions.	3
• Estimation of starch, reducing and non-reducing sugars-reactions of proteins and amino acids.	2
• Estimation of proteins by Lowry method – determination of acid value.	2
• Saponification value, iodine number of vegetable oils-vitamins.	2
• Estimation of ascorbic acidspaper and thin layer chromatography.	2
• Sterilization techniques; preparation of culture medium for establishment of explants of forestry plants.	2
• Multiplication of shoots, induction of roots; meristem culturing; callus cultures.	2
• Induction of organogenesis.	1

References

1. Hattori, T. 1973. Microbial life in the soil. Marcel Dekker Inc. New York.
2. Subba Rao, N.S. 1977. Soil Microorganisms and Plant growth. Oxford and IBH Publications, New Delhi.
3. Subba Rao, N.S. and Y.R. Dommergues. 2000. Microbial interactions in agriculture and forestry. Vol. I & II. Oxford and IBH Publishing Co., New Delhi.
4. Walker, N. 1975. Soil Microbiology. Butterworths, London.
5. Burris, R.G. 1978. Soil Enzymes. Academic Press, New York.
6. Lynch, J.M. 1983. Soil Biotechnology. Blackwell Scientific publications, London.
7. Mehta, S.L., M.L. Lodha and P.V. Sane. 1993. Recent advances in plant biochemistry. Publications and Information Division, ICAR, New Delhi.
8. Subba Rao, N.S. 1993. Biofertilizers in agriculture and forestry. Oxford and IBH Publ. Co., New Delhi. p. 242.
9. Subba Rao, N.S. and C. Rodriguez-Barrueo. 1995. Casuarinas. Oxford & IBH Publ. Co., New Delhi.

Elementary idea of complex number. Arithmetic and Geometric progressions. Elementary idea of permutation and combinations. Binomial theorem for positive integral index, any index and their applications, addition and subtraction formulae. A, B and C, D formulae. Sine and Cosine formulae. Inverse Trigonometric functions. Introduction to matrices and determinants, special type of matrices, addition, subtraction and multiplication of matrices. Inverse of a matrix solution of system of linear equations using Cramer's rule and matrices method. Measures of central tendency and dispersion. Correlation and Regression. Elementary idea of probability theory.

Theory

Content	Lecture
• Elementary idea of complex number.	4
• Arithmetic and Geometric progressions.	4
• Elementary idea of permutation and combinations.	4
• Binomial theorem for positive integral index, any index and their applications.	5
• Addition and subtraction formulae. A, B and C, D formulae.	4
• Sine and Cosine formulae.	4
• Inverse Trigonometric functions.	4
• Introduction to matrices and determinants, special type of matrices, addition, subtraction and multiplication of matrices.	5
• Inverse of a matrix solution of system of linear equations using Cramer's rule and matrices method.	6
• Measures of central tendency and dispersion.	4
• Correlation and Regression.	4
• Elementary idea of probability theory.	3

References

1. Agrwal, R.S. Elementary Mathematics.
2. NCERT, Elementary Mathematics
3. Prasad, G. Differential Calculus.
4. Prasad, G. Integral Calculus.

Theory:

Introduction to trees and their general classification under different forest types. Important tree families and their peculiar characters. Patterns and Parts of typical flowering trees. Morphology of flowers. Structure and types of trees. Difference between the trees and other plant community. Types of trees and canopy structure. Growth-pattern of trees; seedling, saplings, trees, bole and pole stages. Branching patterns of trees. Change in tree morphology with respect to climatic, edaphic and topographic factors. Coniferous and broad leaved tree species. Trees in tropical, sub-tropical, temperate and alpine regions. Significance of tree in human life- tangible and intangible benefits. Identification of different tree species. Important uses of trees.

Theory

Content	Lecture
• Introduction to trees and their general classification under different forest types.	4
• Important tree families and their peculiar characters.	4
• Patterns and Parts of typical flowering trees.	3
• Morphology of flowers.	3
• Structure and types of trees.	3
• Difference between the trees and other plant community.	5
• Types of trees and canopy structure.	3
• Growth-pattern of trees; seedling, saplings, trees, bole and pole stages.	4
• Branching patterns of trees.	3
• Change in tree morphology with respect to climatic, edaphic and topographic factors.	5
• Coniferous and broad leaved tree species.	3
• Trees in tropical, sub-tropical, temperate and alpine regions.	4
• Significance of tree in human life- tangible and intangible benefits.	3
• Identification of different tree species.	3
• Important uses of trees.	2

References

1. Shiva, M.P. A Handbook of Systematic Botany, 1986. IBD Publisher, Dehradun.
2. Sagreiya, K.P. Forests and Forestry, 1997. National Book Trust India.
3. Khanna, L. S. 1984. Principles and Practice of Silviculture, Khanna Bhandu, Dehra Dun. P. 476.
4. Ram Prakash and L.S. Khanna. 1991. Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun. 298p.
5. Dwivedi, A.P. 1993. A Text Book of Silviculture, International Book Distributors, Dehradun.
6. Dwivedi, A. P. 1992. Principles and Practice of Indian Silviculture, Surya Publication, 420p.

Theory:

Computer application: Introduction to computers and personal computers, basic concepts, operating system, DOS and Windows, introduction to programming languages, BASIC language, concepts, basic and programming techniques, MS Office, Win Word, Excel, Power Point, introduction to Multi-Media and its application. VISUAL BASIC-concepts, basic and programming techniques, introduction to Internet. Information management, such as data storage/retrieval, data validation, security of data, data manipulation, presentation of data and report generation – Introduction to commonly used software application packages – Familiarization with commonly used application packages like RDBMS, MS-Office, Word Processing etc.

Practical:

Construction of frequency distribution table and its graphical representation, histogram, frequency polygon, frequency curve, bar chart, simple, multiple, component and percentage bar charts, pie chart, mean, mode for row and grouped data, percentiles, quadrille, and median for row and grouped data, coefficient of variation, 't' test for independent, will equal and unequal variants, paired 't' test, chi-square test for contingency tables and theoretical ratios, correlation and linear regression. Studies on computer components –BASIC language, VISUAL BASIC, programming techniques, MS Office, Excel, PowerPoint.

Theory

Content	Lecture
• Introduction to computers and personal computers, basic concepts, operating system, DOS.	2
• Windows, introduction to programming languages.	1
• BASIC language, concepts, basic and programming techniques.	1
• MS Office, Win Word, Excel, Power Point.	2
• Introduction to Multi-Media and its application.	1
• VISUAL BASIC-concepts, basic and programming techniques, introduction to Internet.	2
• Information management, such as data storage/retrieval, data validation.	1
• Security of data, data manipulation, presentation of data and report generation.	2
• Introduction to commonly used software application packages.	2
• Familiarization with commonly used application packages like RDBMS.	2
• MS-Office, Word Processing etc.	1

Practical

Content	Lecture
• Construction of frequency distribution table and its graphical representation.	2

• Histogram, frequency polygon, frequency curve, bar chart, simple, multiple, component and percentage bar charts, pie chart, mean, mode for row and grouped data, percentiles, quadrille, and median for row and grouped data.	3
• Coefficient of variation, 't' test for independent, will equal and unequal variants,	3
• Paired 't' test, chi-square test for contingency tables and theoretical ratios.	2
• Correlation and linear regression.	1
• Studies on computer components –BASIC language.	2
• VISUAL BASIC, programming techniques,	2
• MS Office, Excel, PowerPoint.	2

References

1. Ron Mansfield, The Compact Guide to Microsoft Office
2. Chris Lewis, Essential Tips: Using the Internet
3. Gene Weisskopf, ABCs of Excel 97
4. Kenneth N.Berk, Introductory Statistics with Systat
5. Kris N, Advanced Data Analysis with Systat
6. Mark Wallace, Things to do on the Internet
7. Chris Lewis, Essential Tips: Using the Internet

SEMESTER – II

SVC-302

FOREST MENSURATION

Cr. 3(2+1)

Introduction, definition, objectives and scope of forest mensuration. Scales of measurement (nominal, ordinal, interval and ratio scale). 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, Finish Parabolic Calliper, Relaskop, Pentaprism. Bark measurements - objectives, thickness, surface area and volume. Crown measurements - objectives, diameter, height, surface area and volume. Height measurements - direct and indirect methods. Height measurement employing geometric and trigonometric principles, height measuring instruments, errors in height measurement. Measurement of cross sectional area, basal area, bole surface area, leaf area. The tree stem form, taper and classification of form factors and form quotient. Volume estimation of felled and standing trees and formulae involved. Volume tables-definition and their classification, (general, regional and local volume tables), merchantable volume tables. Preparation of volume tables. Stand growth, site quality, site index, stand structure, yield tables and preparation of yield tables. Biomass measurement. Determination of age of trees. Tree growth measurements, objectives increment, determination of 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. 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.

Practical:

Units of measurement and their uses. Instruments used in forest mensuration and their working principles, pertaining to tree height, diameter, basal area, bark thickness and crown measurements. Measurement of bark thickness, bark volume, bark area and crown parameters. Volume estimation of logs, felled trees and standing trees. Preparation of volume tables, volume estimation of forest stands. Stump analysis and increment boring. Determination of age of standing trees. Calculation of CAI and MAI. Sampling exercises including Point sampling. Calculation of crop diameter, crop height and crop volume. Estimation of form factor. Estimation of canopy density. Use of aerial photographs in forest inventory. Study of different satellite images and their application in forestry.

Theory

	Content	Lecture
•	Introduction, definition, objectives and scope of forest mensuration.	1
•	Scales of measurement (nominal, ordinal, interval and ratio scale). Units of measurement, standards of accuracy implied in their expression.	2
•	Measurement of single tree - objectives, standard rules governing	2

- measurement at breast height.
- Measurement of tree diameter and girth using rulers, callipers and tapes. Comparison between tape and calliper measurements. 2
- Measurements of upper stem diameter and instruments such as Ruler, Finish Parabolic Calliper, Relaskop, Pentaprism. 3
- Bark measurements - objectives, thickness, surface area and volume. Crown measurements - objectives, diameter, height, surface area and volume. 3
- Height measurements - direct and indirect methods. Height measurement employing geometric and trigonometric principles, height measuring instruments, errors in height measurement. 3
- Measurement of cross sectional area, basal area, bole surface area, leaf area. The tree stem form, taper and classification of form factors and form quotient. 2
- Volume estimation of felled and standing trees and formulae involved. Volume tables-definition and their classification, (general, regional and local volume tables), merchantable volume tables. 3
- Preparation of volume tables. Stand growth, site quality, site index, stand structure, yield tables and preparation of yield tables. 2
- Biomass measurement. Determination of age of trees. Tree growth measurements, objectives increment, determination of increment, stump analysis, stem analysis and increment boring. 3
- Measuring tree crops - objectives, diameter, diameter and girth classes, height measurement of crop, crop age and crop volume. Stand tables. 2
- Forest inventory- definition, objectives, kinds of enumeration. Sampling - definition, advantages, kinds of sampling, random sampling: (simple, stratified, multistage and multiphase sampling). 2
- Non random sampling (selective, systematic and sequential sampling) sampling design, size and shape of the sampling units. 2
- Point sampling - horizontal and vertical point sampling. Introduction to remote sensing and its application in forestry. 2

Practical

Content	Lecture
• Units of measurement and their uses. Instruments used in forest mensuration and their working principles, pertaining to tree height, diameter, basal area, bark thickness and crown measurements.	4
• Measurement of bark thickness, bark volume, bark area and crown parameters. Volume estimation of logs, felled trees and standing trees.	2
• Preparation of volume tables, volume estimation of forest stands.	1
• Stump analysis and increment boring.	1
• Determination of age of standing trees.	2
• Calculation of CAI and MAI.	1
• Sampling exercises including Point sampling.	1
• Calculation of crop diameter, crop height and crop volume.	1
• Estimation of form factor. Estimation of canopy density.	1
• Use of aerial photographs in forest inventory.	2

- Study of different satellite images and their application in forestry.

1

References

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2. Avery, T.E. 1967. Forest Measurements. Mc Grand Hill Book Company, New York.
3. Hamilton, G.L. 1988. Forest Mensuration Handbook. Periodical Expert Book Agency.
4. Husch, B., C.I. Miller and T.N. Beers. 1982. Forest Mensuration. The Ronald Press Company, New York.
5. Maslekar, A.R. 1990. Foresters Companions. Jugal Kishore and Co. (Publn. Dvn.), Dehra Dun. P. 603.

Theory:

The multidisciplinary nature of environmental studies: Definition, scope and importance-Need for public awareness- Ecosystems-Concept of an ecosystem-Structure and function of an ecosystem-Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the following ecosystem-a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries). Social Issues and the Environment- From unsustainable to sustainable development-Urban problems and related to energy-Water conservation, rain water harvesting, watershed management-Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environmental Protection Act. Air (Prevention and Control of Pollution) Act-Water (Prevention and control of Pollution) Act-Wildlife Protection Act-Forest Conservation Act-Issues involved in enforcement of environmental legislation-Public awareness

Theory

	Lectures
• The multidisciplinary nature of environmental studies-Definition, scope and importance	1
• Need for public awareness	1
• Ecosystems -Concept of an ecosystem	1
• Structure and function of an ecosystem	1
• Producers, consumers and decomposers	1
• Energy flow in the ecosystem	1
• Ecological succession	1
• Food chains, food webs and ecological pyramids	1
• Introduction, types, characteristic features, structure and function of Ecosystem	1
• Forest ecosystem	1
• Grassland ecosystem	1
• Desert ecosystem	1
• Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)	2
• Social Issues and the Environment -From unsustainable to sustainable development	1
• Urban problems and related to energy	1
• Water conservation, rain water harvesting, watershed management	2
• Resettlement and rehabilitation of people; its problems and concerns. Case studies	1
• Environmental ethics: Issues and possible solutions	1

• Climate change	1
• Global warming.	1
• Acid rain	1
• Ozone layer depletion	1
• Nuclear accidents and holocaust. Case studies	1
• Wasteland reclamation	1
• Consumerism and waste products	1
• Environmental Protection Act	1
• Air (Prevention and Control of Pollution) Act	1
• Water (Prevention and control of Pollution) Act	1
• Wildlife Protection Act	1
• Forest Conservation Act	1
• Issues involved in enforcement of environmental legislation	1
• Public awareness	1

Reference:

1. Dhameja, S.K. Environmental Studies 2007. S. K. Kataria and Sons, New Delhi 110006
2. Gupta, K.M. Environment and Ecology, 2008. Umesh Publication, New Delhi.
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4. Deswal, S. Environmental Studies 2007. S. K. Kataria and Sons, New Delhi 110006

SAC-406 INTRODUCTION TO FOREST SOIL SCIENCE & GEOLOGY
Cr. 2(1+1)

Theory

Introduction; Forest soils Vs. cultivated soils. Properties of soils under different forest ecosystems. 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. N,P and K, Macro and micronutrient fertilizers and their uses. Brief history of Microbiology. Forest soil environment-distribution of various microorganisms in soil ecosystem and their interaction effects. Mineral Transformation-carbon cycle with reference to organic matter decomposition and humus formation, Microbial degradation of cellulose & lignin. Bio-fertilizers – their importance. Nitrogen fixation-Rhizobium-tree legume symbiosis, Frankia X non-legume symbiosis, asymbiotic and associative N₂ fixation. Nitrification and denitrification in forest ecosystems. Microbial transformation of phosphorous, sulphur and micro nutrients. Mycorrhizae: types, biology and importance with specific relevance to tree crops and mobilization of phosphorus and micro-nutrients. Rhizosphere and phyllosphere concept.

Composition of earth's crust, soil as a natural body-major components by volume-pedologyrocks- types- Igneous-sedimentary and metamorphic-classification-soil forming minerals definition- classification-silicates-oxides carbonates – sulphides - phosphates-occurrence. Weathering of rocks and minerals-weathering factors-physical-chemical-biological agents involved, weathering indices-factors of soil formation, land forms-parent material-climate organism-relief-time-soil forming processes-eluviations and illuviation-formation of various soils.

Practical

Visit to different forest ecosystems to study the soil profile & soil sampling - Study of properties of minerals — Study of Igneous rocks – Study of Sedimentary rocks – Study of Metamorphic rocks – Methods of soil sampling and preparation of soil sample – Mechanical Analysis by International pipette method – Estimation of Soil Moisture content - Determination of soil colour – Determination of Bulk density by cold method – Determination of B.D.– Determination of particle density – Determination of soil pH by calorimetric method – Determination of soil pH by pH meter – Determination of Electrical Conductivity. Identification of rocks and minerals; Collection and preparation of soil samples.

Theory

	Content	Lecture
•	Forest soils Vs. cultivated soils.	1
•	Properties of soils under different forest ecosystems.	1
•	Soil colloids and exchange phenomenon.	1
•	Essential nutrient elements-occurrence, availability and their functions.	1
•	Diagnosis of nutrient deficiencies-visual symptoms, soil fertility evaluation methods.	1
•	Site productivity and nutrient cycling in forest soils.	1

- N,P and K, Macro and micronutrient fertilizers and their uses. 1
- Brief history of Microbiology. Forest soil environment-distribution of various microorganisms in soil ecosystem and their interaction effects. 1
- Mineral Transformation-carbon cycle with reference to organic matter decomposition and humus formation, Microbial degradation of cellulose & lignin. 1
- Bio-fertilizers – their importance. Nitrogen fixation-Rhizobium-tree legume symbiosis, Frankia X non-legume symbiosis, asymbiotic and associative N₂ fixation. 1
- Nitrification and denitrification in forest ecosystems. Microbial transformation of phosphorous, sulphur and micro nutrients. 1
- Mycorrhizae: types, biology and importance with specific relevance to tree crops and mobilization of phosphorus and micro-nutrients. 1
- Rhizosphere and phyllosphere concept. 1
- Composition of earth's crust, soil as a natural body-major components by volume-pedology rocks- types. 1
- Igneous-sedimentary and metamorphic-classification-soil forming minerals definition- classification-silicates-oxides carbonates – sulphides - phosphates-occurrence. 1
- Weathering of rocks and minerals-weathering factors-physical-chemical-biological agents involved. 1
- Weathering indices-factors of soil formation, land forms-parent material-climate organism-relief-time-soil forming processes-eluviations and illuviation-formation of various soils. 1

Practical

Content	Lecture
• Visit to different forest ecosystems to study the soil profile & soil sampling.	2
• Study of properties of minerals	1
• Study of Igneous rocks	1
• Study of Sedimentary rocks	1
• Study of Metamorphic rocks	1
• Methods of soil sampling and preparation of soil sample	1
• Mechanical Analysis by International pipette method	1
• Estimation of Soil Moisture content	1
• Determination of soil colour	1
• Determination of Bulk density by cold method	1
• Determination of B.D.– Determination of particle density	1
• Determination of soil pH by calorimetric method	1
• Determination of soil pH by pH meter	1
• Determination of Electrical Conductivity.	1
• Identification of rocks and minerals; Collection and preparation of soil samples.	2

References

1. Armson, K.A. Forest Soils, 1977, IBD Publisher, Dehradun.
2. Gale, M,R. Forest Soil Research, 2006. IBD Publisher, Dehradun.
3. Bredy,N.C. Soil Sciences
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5. Black, C.A. 1993. Soil fertility evaluation and control, Lewis publishers, London. fertilisers 5th edition Macmillan Publishing Co., New York.
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8. Allison, F.C. 1973. Soil organic matter and its role in crop production. Elsevier Scientific Publishing Co., Amsterdam.
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10. Stevenson, F.J. 1982. Humus chemistry: genesis, composition, reactions. John Wiley and Sons, New York.

Theory

Introduction – importance and scope of dendrology, Morphology of woody plants and range of variation. Principles and systems of classification of plants. Bentham and Hooker's, Engler and Prantles, and Hutchinson's Systems. Plant Nomenclature – objectives, principles and International Code of Botanical Nomenclature. Role of vegetative morphology in identification of woody forest flora. Peculiarities of tree stems, twigs, general form of woody trunk and deviations like buttresses, flutes, crooks, etc. Morphology and description of barks

of common trees. Characteristics of blaze on bark, colour, gums, latex, etc. Morphology of leaf, description of different types of leaves, colour of young and old leaves in some species as (regular) features of identification. Reproductive morphology of plants with reference to description and identification of reproductive parts. Floristics and procedures; herbarium techniques, collection, processing and preservation of plant material. General study of herbarium, arboretum and xylarium. Description of the plant in scientific terms, study of sport characteristics of plants, naming and classifying based on adopted system. Study of families, as survey of forest resources: Magnoliaceae, Rhizophoraceae, Ebenaceae, Sapotaceae, Caesalpiniaceae, Santalaceae, Mimosaceae, Elaeagnaceae, Papilionaceae, Meliaceae, Salicaceae, Apocynaceae, Betulaceae, Verbenaceae, Fagaceae, Compositae, Moraceae, Poaceae, Tiliaceae, Liliaceae, Euphorbiaceae, Pinaceae, Dipterocarpaceae, Cupressaceae, Guttiferae, Taxaceae, Myrtaceae and Combretaceae. Geographical distribution of important Indian trees, native trees, exotic trees, endemism, allelopathy with respect to forest trees.

Practical :

Morphological description of plant parts and method of collection of plants.

Techniques of preparing herbarium specimens. Study of woody flora of: Magnoliaceae, Ebenaceae and Tiliaceae; Leguminosae, Betulaceae, Fagaceae; Dipterocarpaceae, Guttiferae and Liliaceae; Moraceae and Poaceae; Meliaceae, Elaeagnaceae and Salicaceae; Leguminosae and Apocynaceae; Combretaceae, Lythraceae, Myrtaceae and Santalaceae; Asteraceae, Ebenaceae, Sapotaceae and Verbenaceae; Euphorbiaceae, Pinaceae, Cupressaceae, Taxaceae.

Theory

	Content	Lecture
•	Importance and scope of dendrology, Morphology of woody plants and range of variation	1
•	Principles and systems of classification of plants.	1
•	Bentham and Hooker's, Engler and Prantles, and Hutchinson's Systems.	1
•	Plant Nomenclature – objectives, principles and International Code of Botanical Nomenclature.	1
•	Role of vegetative morphology in identification of woody forest flora.	1
•	Peculiarities of tree stems, twigs, general form of woody trunk and deviations like buttresses, flutes, crooks, etc. Morphology and description of	1

- barks of common trees.
- Characteristics of blaze on bark, colour, gums, latex, etc. Morphology of leaf, description of different types of leaves, colour of young and old leaves in some species as (regular) features of identification. 1
- Reproductive morphology of plants with reference to description and identification of reproductive parts. 1
- Floristics and procedures; herbarium techniques, collection, processing and preservation of plant material. General study of herbarium, arboretum and xylarium. 1
- Description of the plant in scientific terms, study of sport characteristics of plants, naming and classifying based on adopted system. 1
- Study of families, as survey of forest resources: Magnoliaceae, Rhizophoraceae, Ebenaceae, Sapotaceae, 1
- Study of families, as survey of forest resources Caesalpiniaceae, Santalaceae, Mimosaceae, Elaeagnaceae, 1
- Study of families, as survey of forest resources Papilionaceae, Meliaceae, Salicaceae, Apocynaceae, Betulaceae, Verbenaceae 1
- Study of families, as survey of forest resources Fagaceae, Compositae, Moraceae, Poaceae, Tiliaceae, Liliaceae. 1
- Study of families, as survey of forest resources Euphorbiaceae, Pinaceae, Dipterocarpaceae, Cupressaceae, 1
- Study of families, as survey of forest resources Guttiferae, Taxaceae, Myrtaceae and Combretaceae. 1
- Geographical distribution of important Indian trees, native trees, exotic trees, endemism, allelopathy with respect to forest trees. 1

Practical

Content	Lecture
• Morphological description of plant parts and method of collection of plants.	1
• Techniques of preparing herbarium specimens.	1
• Study of woody flora of: Magnoliaceae, Ebenaceae and Tiliaceae, Leguminosae	3
• Study of woody flora of: Betulaceae, Fagaceae; Dipterocarpaceae, Guttifereae	3
• Study of woody flora of: Liliaceae; Moraceae and Poaceae; Meliaceae, Elaeagnaceae Study of woody flora of: Salicaceae; Legumenosae and Apocynaceae; Combretaceae	3
• Study of woody flora of: Lythraceae, Myrtaceae, Santaleceae; Asteraceae, Ebenaceae	3
• Study of woody flora of: Sapotaceae and Verbenaceae; Euphorbiaceae, Pinaceae, Cupressaceae, Taxaceae.	3

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2. Luna, R.K. 1988. Plantation Forestry In India. International Book Distributors, Dehradun. p 476.
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4. Daniel Sundararaj,D. and G.Thulasidas.(1993). Botany of Field Crops. (2nd Ed.). Macmilan India Ltd.
5. Sagreiya, K.P. Forests and Forestry, 1997. National Book Trust India.
6. Khanna, L. S. 1984. Principles and Practice of Silviculture, Khanna Bhandu, Dehra Dun. P. 476.

Theory

Nature and scope of forest economics, importance of forestry in economic development. Concepts of demand, derived demand and supply with special reference forestry outputs. Basics of marginal analysis and its applications in economic analysis of forestry production systems. Basics of Linear Programming. Financial and economic rotations. Fundamentals of project planning and evaluation and network scheduling techniques. Valuation of timber and non-timber forest products.

Economics as social science – Forest Economics - Definitions and concepts – Nature and scope of Forest economics - Divisions of Forest economics – Approaches to the study of Forest economics – Forest Economics Vs Agricultural Economics.

Consumption – theory of consumer behavior – laws of consumption – classification of goods – wants their characteristics and classification – Utility and its measurement – cardinal and ordinal – Law of Diminishing Marginal Utility - Law of Equimarginal utility – Indifference curve and its Properties – Consumer equilibrium. Theory of demand – demand schedule and Curve – market demand – price, income and cross elasticity's Engel's law of family Expenditure – Consumer's surplus.

Theory of firm –factors of production – land and its characteristics – labour and division of labor – theories of population – capital and its characteristics – classification of capital – capital formation – enterprises-forms of business organisation merits and demerits. Laws of returns – Law of Diminishing Marginal Returns Returns . Cost concepts Law of Supply- supply schedule and curve –elasticized market equilibrium. Distribution – theories of rent, wage interest and profit. National income – Sectoral distribution. Money –theory and functions of money. Banking – role of central and commercial banks. Public finance and taxation. Inflation and control measures. International trade and balance of payments.

Theory

Content	Lecture
• Nature and scope of forest economics, importance of forestry in economic development.	2
• Concepts of demand, derived demand and supply with special reference forestry outputs.	2
• Basics of marginal analysis and its applications in economic analysis of forestry production systems.	2
• Basics of Linear Programming.	1
• Financial and economic rotations.	1
• Fundamentals of project planning and evaluation and network scheduling techniques. Valuation of timber and non-timber forest products.	2
• Economics as social science – Forest Economics - Definitions and concepts – Nature and scope of Forest economics.	2
• Divisions of Forest economics – Approaches to the study of Forest economics – Forest Economics Vs Agricultural Economics.	2

- Consumption – theory of consumer behavior – laws of consumption – classification of goods – wants their characteristics and classification – Utility and its measurement – cardinal and ordinal. 2
- Law of Diminishing Marginal Utility - Law of Equimarginal utility – Indifference curve and its Properties – Consumer equilibrium. 2
- Theory of demand – demand schedule and Curve – market demand – price, income and cross elasticity’s Engel’s low of family Expenditure – Consumer’s surplus. 3
- Theory of firm –factors of production – land and its characteristics – labour and division of labor – theories of population – capital and its characteristics – classification of capital – capital formation – enterprises-forms of business organisation merits and demerits. 3
- Laws of returns – Low of Diminishing Magginal Returns Returns . 2
- Cost concepts Law of Supply- supply schedule and curve –elasticized market equilibrium. Distribution – theories of rent, wage interest and profit. 2
- National income – Seetoral distribution. Money –theory and functions of money. 2
- Banking – role of central and commercial banks. 1
- Public finance and taxation. 1
- Inflation and control measures. 1
- International trade and balance of payments. 1

References

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CE-310 SURVEYING AND LEVELING Cr. 3(2+1)

Theory:

Surveying: Introduction, classification and basic principles, Linear measurements. Chain surveying. Compass survey. Errors in measurements, their elimination and correction. Plane table surveying. Levelling, Contouring, Computation of area and volume. Theodolite traversing. Introduction to setting of curves.

Practical:

Chain survey of an area and preparation of map; Compass survey of an area and plotting of compass survey; Plane table surveying; Leveling. L-section and X-sections and its plotting; Contour survey of an area and preparation of contour map; Introduction of software in drawing contour; Theodolite surveying; Ranging by theodolite, Height of object by using theodolite; Setting out curves by theodolite; Minor instruments.

Theory

Content	Lecture
• Introduction, classification and basic principles, Linear measurements.	5
• Chain surveying. Compass survey.	4
• Errors in measurements, their elimination and correction.	5
• Plane table surveying.	5
• Levelling, Contouring, Computation of area and volume.	5
• Theodolite traversing.	5
• Introduction to setting of curves.	5

Practical

Content	Lecture
• Chain survey of an area and preparation of map.	1
• Compass survey of an area and plotting of compass survey	2
• Plane table surveying; Leveling.	2
• L-section and X-sections and its plotting	2
• Contour survey of an area and preparation of contour map	2
• Introduction of software in drawing contour	2
• Theodolite surveying; Ranging by theodolite	2
• Height of object by using theodolite	2
• Setting out curves by theodolite	1
• Minor instruments.	1

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2. Michal, A.M. Irrigation: Theory and Practises.
3. Ram Parkash. 1983. Forest surveying. International Book Distributors, Dehradun. 368 p.

EXT-304 FUNDAMENTALS OF EXTENSION EDUCATION & COMMUNITY DEVELOPMENT Cr. 2(1+1)

Theory:

Extension Education : Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry extension: process, principles and selected programmes of leading national and international forest institutes. People's participation in forestry programmes. Motivation of women community, children, youth and voluntary organizations for forestry extension work. Rural Development: meaning, definition, objectives and genesis. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR. Communication: meaning, definition, elements and selected models. Audio – visual aids: importance, classification and selection. Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership. Community Development : Meaning, definition and objectives of Community Development – Changes in concepts of models – Organisational set up and Activities of Community Development at State, District, Block and Village level

Practical:

Fundamentals of Extension Education & Community Development : Practice in conduction survey – Practice in preparing schedule and questionnaire for studying the organizational set up of Community Development – Contact with the Farmers and educating them in new Technology of Agriculture. Extension Programme Planning, Monitoring & Evaluation : Practice in preparation of farm production plan – Development programme for a village and a block – Preparation of an outline and practice on evaluation of a programme – Writing study reports.

Theory

Content	Lecture
• Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history.	1
• Forestry extension: process, principles and selected programmes of leading national and international forest institutes.	1
• People's participation in forestry programmes. Motivation of women community, children, youth and voluntary organizations for forestry extension work.	2
• Rural Development: meaning, definition, objectives and genesis.	1
• Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR.	2
• Communication: meaning, definition, elements and selected models.	1
• Audio – visual aids: importance, classification and selection.	1

- Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods. 2
- Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). 1
- Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership. 2
- Community Development: Meaning, definition and objectives of Community Development – Changes in concepts of models – Organisational set up and Activities of Community Development at State, District, Block and Village level 2

Practical

Content	Lecture
• Fundamentals of Extension Education & Community Development: Practice in conduction survey.	3
• Practice in preparing schedule and questionnaire for studying the organizational set up of Community Development.	3
• Contact with the Farmers and educating them in new Technology of Agriculture.	2
• Extension Programme Planning, Monitoring & Evaluation .	2
• Practice in preparation of farm production plan	1
• Development programme for a village and a block.	2
• Preparation of an outline and practice on evaluation of a programme	2
• Writing study reports.	2

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Theory

Introduction – Seed and its importance – afforestation activity and seed requirements in India and UP. Role of seed technology in nursery stock production. Production of quality seed, identification of seed collection areas-seed orchards – Location and maintenance of seed orchards-isolation and roguing, seed source, provenance and stands. Selection of seed tree, genotypic and phenotypic selection, plus tree – pure stands, elite seed tree, isolated tree and their location. Locality factors. Seed Collection – Planning and Organization, Collection methods, Factors affecting seed collection, Seed maturity and tests. Seed processing – Seed extraction, drying, blending, cleaning, grading, treating, bagging, labeling and storage. Storage – orthodox and recalcitrant seeds, precautions of handling of recalcitrant seeds, natural longevity of tree seeds, factors affecting longevity – storage conditions, methods and containers. Seed testing, sampling, mixing and dividing, determination of genuineness, germination, moisture, purity, vigour, viability, seed dormancy and breaking of seed dormancy. Different viability and vigour tests, seed pelleting, seed health. Classes of tree seeds, certification procedures of tree seeds.

Practical:

Identification of seeds of tree species; Seed maturity tests; Physical purity analysis; Determination of seed moisture; Seed germination test; Hydrogen peroxide test; Tetrazolium test for viability; Seed vigour and its measurements; Methods of breaking dormancy in tree seeds; Testing membrane permeability; Study of seed collection and equipments; Planning of seed collection; Seed collection; Seed extraction; Visit to seed production area and seed orchard; Visit to seed processing unit/testing laboratory; Study of seed sampling equipments. Note: Region specific aspects may be changed based on the locality

Theory

Content	Lecture
• Introduction – Seed and its importance	1
• Afforestation activity and seed requirements in India and UP.	1
• Role of seed technology in nursery stock production.	1
• Production of quality seed, identification of seed collection areas	1
• Seed orchards – Location and maintenance of seed orchards-isolation and roguing.	1
• Seed source, provenance and stands.	1
• Selection of seed tree, genotypic and phenotypic selection.	1
• Plus tree – pure stands, elite seed tree, isolated tree and their location.	1
• Seed Collection – Planning and Organization.	1
• Collection methods, Factors affecting seed collection.	1
• Seed maturity and seed testing.	1
• Seed processing – Seed extraction, drying, blending, cleaning, grading, treating, bagging, labeling and storage.	1
• Storage – orthodox and recalcitrant seeds, precautions of handling of recalcitrant seeds, natural longevity of tree seeds.	1
• Factors affecting longevity – storage conditions, methods and containers.	1

- Seed testing, sampling, mixing and dividing, determination of genuineness, germination, moisture, purity, vigour, viability. 1
- Seed dormancy and breaking of seed dormancy. 1
- Different viability and vigour tests, seed pelleting, seed health. 1
- Classes of tree seeds, certification procedures of tree seeds. 1

Practical

Content	Lecture
• Identification of seeds of tree species	2
• Seed maturity tests	1
• Physical purity analysis	1
• Determination of seed moisture	1
• Seed germination test; Hydrogen peroxide test; Tetrazolium test for viability	2
• Seed vigour and its measurements	1
• Methods of breaking dormancy in tree seeds	1
• Testing membrane permeability	1
• Study of seed collection and equipments	1
• Planning of seed collection; Seed collection; Seed extraction	2
• Visit to seed production area and seed orchard	1
• Visit to seed processing unit/testing laboratory	1
• Study of seed sampling equipments.	1

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Theory

Agrometeorology-definition, aim and scope. Factors and elements of weather and climate. Composition and structure of atmosphere. Air and soil temperature regimes, atmospheric humidity, types of clouds and precipitation, hails and frost. Cyclones, anticyclones and thunderstorms. Solar radiations-components and effect on plant growth. Wind as a source of energy. Effect of weather and climate on the growth and development of crops. Climatic normals for crops. Agroclimatic zones of India and Uttar Pradesh. Evaporation and transpiration. Use of remote sensing techniques in agrometeorology. Agriculture weather forecasting.

Practical:

Study of temperature instruments, pressure instruments, humidity instruments, wind instruments, rain instruments and wind rose. Solar radiation instruments with pyranometer. Monthly variation of rainfall at Allahabad. Lay out of an agromet observatory and types. Measurement of wind and evaporation. Measurement of sunshine hours. Measurement of soil temperature and dew.

Theory

Content	Lecture
• Agrometeorology-definition, aim and scope.	1
• Factors and elements of weather and climate.	1
• Composition and structure of atmosphere.	1
• Air and soil temperature regimes, atmospheric humidity, types of clouds and precipitation, hails and frost.	3
• Cyclones, anticyclones and thunderstorms.	2
• Solar radiations-components and effect on plant growth.	1
• Wind as a source of energy.	1
• Effect of weather and climate on the growth and development of crops.	2
• Climatic normals for crops.	1
• Agroclimatic zones of India and Uttar Pradesh.	1
• Evaporation and transpiration.	1
• Use of remote sensing techniques in agrometeorology.	1
• Agriculture weather forecasting.	1

Practical

Content	Lecture
• Study of temperature instruments, pressure instruments, humidity instruments, wind instruments, rain instruments and wind rose.	4
• Solar radiation instruments with pyranometer.	3
• Monthly variation of rainfall at Allahabad	2
• Lay out of an agromet observatory and types.	2
• Measurement of wind and evaporation.	2
• Measurement of sunshine hours.	2
• Measurement of soil temperature and dew.	2

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SEMESTER – III

SVC-401 FOREST MANAGEMENT AND WORKING PLAN Cr. 3(2+1)

Theory:

Introduction: definition and scope. Peculiarities of forest management. Principles of forest management and their applications. Objects of management, purpose and policy. Sustained and progressive yield concept and meaning. General definitions – management and administrative units, felling cycle, cutting section. Rotations: definition, kinds of rotations, choice of rotations, length of rotations and conversion period. Normal forest: definition and concept. Evenaged and unevenaged models. Estimation of growing stock, density, quantity and increment. Yield regulation – general principles of even aged and unevenaged forest crop. Yield regulation based on area, volume, area and volume, increment and number of trees. Working Plan – definition, objects and necessity.

Normal age gradation in regular and irregular forests – felling series in selection forest and coppice with standard system – Increment - CAI –MAI – relationship. Growing stock – concept and definition –determination of growing stock – Normal growing stock in regular, shelter wood system, selection system. Joint forest management _ concept and methodology – successful citations for Indian Scenario. Working plans – Introduction - definitions – object and scope –preparation of working plans – preliminary working plan report. Constitution of a Working Plan division –fieldwork – compartment histories – maps –workingplan map, soil map, regeneration maps, forest type map, management map. Method of writing working plan – Part-I and Part II – Use of modern tools in WP preparation.

Practical:

Visit to plantations of different age gradations, record the actual growing stock and workout increments. Visit to forests and enumerate the stock and test one of the method for yield regulation. Study the various units adopted in the forest management. Study of various records and forms maintained in the office of the RFO with regard to management of forests under their control. Study of procedure for seizure of property. Visit to forest department and courts to observe penalty procedures. Preparation of first information report and enactment report. Study of working plans of the forests and to prepare the working plan for one of the area in the range. Estimation of MAI and CAI – Fixation of rotation for species. Preparation of working plan –field work – stock map and quality class map preparations – sample plots and collection of data by plot sampling and point sampling –writing working plan.

Theory

Content	Lecture
• Introduction: definition and scope. Peculiarities of forest management.	2
• Principles of forest management and their applications.	1
• Objects of management, purpose and policy. Sustained and progressive yield concept and meaning.	2
• General definitions – management and administrative units, felling cycle, cutting section. Rotations: definition, kinds of rotations, choice of rotations, length of rotations and conversion period.	3

- Normal forest: definition and concept. Evenaged and unevenaged models. 2
- Estimation of growing stock, density, quantity and increment. 2
- Yield regulation – general principles of even aged and unevenaged forest crop. 2
- Yield regulation based on area, volume, area and volume, increment and number of trees. 2
- Working Plan – definition, objects and necessity. 2
- Normal age gradation in regular and irregular forests – felling series in selection forest and coppice with standard system 2
- Increment - CAI –MAI – relationship. 2
- Growing stock – concept and definition –determination of growing stock – Normal growing stock in regular, shelter wood system, selection system. 2
- Joint forest management _ concept and methodology – successful citations for Indian Scenario. 3
- Working plans – Introduction - definitions – object and scope –preparation of working plans – preliminary working plan report. 2
- Constitution of a Working Plan division –fieldwork – compartment histories – maps –working plan map, soil map, regeneration maps, forest type map, management map. 2
- Method of writing working plan – Part-I and Part II – Use of modern tools in WP preparation. 2

Practical

Content	Lecture
• Visit to plantations of different age gradations, record the actual growing stock and workout increments.	2
• Visit to forests and enumerate the stock and test one of the methods for yield regulation.	1
• Study the various units adopted in the forest management.	1
• Study of various records and forms maintained in the office of the RFO with regard to management of forests under their control.	2
• Study of procedure for seizure of property.	1
• Visit to forest department and courts to observe penalty procedures.	1
• Preparation of first information report and enactment report.	1
• Study of working plans of the forests and to prepare the working plan for one of the area in the range.	2
• Estimation of MAI and CAI – Fixation of rotation for species.	2
• Preparation of working plan –field work – stock map and quality class map preparations	2
• Sample plots and collection of data by plot sampling and point sampling – writing working plan.	2

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SVC-402 SILVICULTURAL SYSTEMS Cr. 2(2+0)

Theory

Silvicultural system - definition, scope and classification. Even aged and uneven aged forests and their crown classes. Detailed study of the silvicultural systems: Clear felling systems including clear strip, alternate and progressive strip systems. Shelterwood system – Uniform system, Group system, Shelterwood strip system, Wedge system, Strip and group system, Irregular shelterwood system, Indian irregular shelterwood system. Seed tree method. Selection system and its modifications. Accessory systems. Coppice system – Simple coppice system, Coppice of the two rotation system, Shelterwood coppice system, Coppice with standard system, Coppice-with-reserve, Coppice selection system, Pollard system. Conversion and its implications. Choice of silvicultural system. Dauerwald concept. Culm selection system in Bamboo. Tending operations - weeding, cleaning, thinnings, definitions, objectives and methods, increment felling and improvement felling. Pruning and lopping. Control of climbers and undesirable plants.

Theory

Content	Lecture
• Silvicultural system - definition, scope and classification.	3
• Even aged and uneven aged forests and their crown classes.	1
• Detailed study of the silvicultural systems	2
• Clear felling systems including clear strip, alternate and progressive strip systems.	2
• Shelterwood system – Uniform system	2
• Group system, Shelterwood strip system	2
• Wedge system, Strip and group system	1
• Irregular shelterwood system, Indian irregular shelterwood system.	2
• Seed tree method. Selection system and its modifications.	2
• Accessory systems. Coppice system – Simple coppice system	2
• Coppice of the two rotation system, Shelterwood coppice system	2
• Coppice with standard system, Coppice-with-reserve	2
• Coppice selection system, Pollard system.	2
• Conversion and its implications. Choice of silvicultural system.	2
• Dauerwald concept. Culm selection system in Bamboo.	1
• Tending operations - weeding, cleaning, thinnings,	2
• Definitions, objectives and methods, increment felling and improvement felling.	1
• Pruning and lopping.	2
• Control of climbers and undesirable plants.	1

References

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FBL-401 FOREST ENTOMOLOGY AND PEST MANAGEMENT Cr. 3(2+1)

Theory

Definition, importance and scope of Entomology. Definition of insect and its position in the Animal Kingdom. Important characters of phylum arthropoda and class insecta. External morphology of generalized insect. Insect growth and development, Reproduction in insects, immature stages (Egg, Larvae/Nymph and Pupae); metamorphosis in Insects Taxonomic classification of class Insecta, diagnostic characters of the orders and major families of economic importance. History and importance of Forest Entomology in India. Methods and principles of pest control: Mechanical, physical, silvicultural, legal, biological and chemical. Principles and techniques of Integrated Pest Management in forests. Classification of forest pests : types of damages and symptoms; factors for outbreak of pests. Nature of damage and management: Insect pests of forest seeds, forest nursery and standing trees of timber yielding species of natural forest (Tectona, Dalbergia sp., Sal, Albizia spp., Sandal, Ailanthus, Gmelina, Terminalia, Deodar, Pines); Plantation forest species (Eucalyptus, Bamboo, Casuarina, Neem, Acacia) Fruit trees (Emblica, Ber, Eugenia, Tamarind). Insect pests of freshly felled trees, finished timbers and their management. Morphology of plant parasitic nematodes, brief classification of important genera of nematodes. Important diseases caused by different genera and their management practices.

Practical:

Study of distinguishing characters of phylum Arthropoda; Study of morphology, mouthparts and appendages of cockroach; Study of different types of insects; Study of immature stages of insects; Study of Anatomy of cockroach; Study of Insect collection, pinning, labelling and preservation; Study of representatives of insect orders and families; Study of predators and parasites; 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; Study of morphological characters of nematodes; Extraction of plant parasitic nematodes; Important symptoms of plant parasitic nematodes; Visit to forest nurseries and plantations.

Theory

Content	Lecture
• Definition, importance and scope of Entomology.	1
• Definition of insect and its position in the Animal Kingdom.	2
• Important characters of phylum arthropoda and class insecta.	2
• External morphology of generalized insect.	2
• Insect growth and development, Reproduction in insects, immature stages (Egg, Larvae/Nymph and Pupae)	3
• Metamorphosis in Insects Taxonomic classification of class Insecta, diagnostic characters of the orders and major families of economic importance.	3
• History and importance of Forest Entomology in India.	2
• Methods and principles of pest control: Mechanical, physical, silvicultural,	2

- legal, biological and chemical.
- Principles and techniques of Integrated Pest Management in forests. 1
- Classification of forest pests : types of damages and symptoms; factors for outbreak of pests. 2
- Nature of damage and management: Insect pests of forest seeds, forest nursery and standing trees of timber yielding species of natural forest (Tectona, Dalbergia sp., Sal, Albizia spp., Sandal, Ailanthus, Gmelina, Terminalia, Deodar, Pines). 4
- Plantation forest species (Eucalyptus, Bamboo, Casuarina, Neem, Acacia). 2
- Fruit trees (Emblica, Ber, Eugenia, Tamarind). 2
- Insect pests of freshly felled trees, finished timbers and their management. 2
- Morphology of plant parasitic nematodes, brief classification of important genera of nematodes. 2
- Important diseases caused by different genera and their management practices. 2

Practical

Content	Lecture
• Study of distinguishing characters of phylum Arthropoda	1
• Study of morphology, mouthparts and appendages of cockroach	1
• Study of different types of insects	1
• Study of immature stages of insects	1
• Study of Anatomy of cockroach	1
• Study of Insect collection, pinning, labelling and preservation	1
• Study of representatives of insect orders and families	1
• Study of predators and parasites	1
• Study of insecticides and their formulations, plant protection appliances	1
• Study of insect pests of forest seeds and forest nurseries	1
• Study of insect pests of standing trees, freshly felled trees and finished products	3
• Study of morphological characters of nematodes	1
• Extraction of plant parasitic nematodes	1
• Important symptoms of plant parasitic nematodes	1
• Visit to forest nurseries and plantations.	1

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LPM-425 LIVESTOCK MANAGEMENT Cr. 2(1+1)

Theory

Important breeds of cattle, buffalo, sheep and goat. Breeding and reproductive management for higher productivity – breeding systems, estrous cycle, heat detection and artificial insemination. Feeding management – types of feedstuffs available for feeding livestock. Feed nutrients and their functions in animal body. Assessing nutritive value of feed – estimation of feed nutrients by proximate and Van Soest methods, estimation of digestible nutrients and energy in feedstuffs. Principles of rationing. Milk – definition, composition and nutritive value. Factors affecting quantity and quality of milk. Prevention and control of diseases.

Practical:

Different tools/instruments used in livestock management; Routine management practices followed on livestock farms; Identification of feedstuffs and their nutritive value; Nutritive requirement animals; Computation of rations for livestock; Study of housing systems and requirements; Study of dairy farm records; Analysis of milk for fat, acidity, total solids and specific gravity; Preservation of fodder as hay⁶, silage and leaf meal.

Theory

Content	Lecture
• Important breeds of cattle, buffalo, sheep and goat.	2
• Breeding and reproductive management for higher productivity – breeding systems, estrous cycle, heat detection and artificial insemination.	3
• Feeding management – types of feedstuffs available for feeding livestock.	2
• Feed nutrients and their functions in animal body.	1
• Assessing nutritive value of feed	1
• Estimation of feed nutrients by proximate and Van Soest methods	2
• Estimation of digestible nutrients and energy in feedstuffs.	1
• Principles of rationing.	1
• Milk – definition, composition and nutritive value.	2
• Factors affecting quantity and quality of milk.	1
• Prevention and control of diseases.	1

Practical

Content	Lecture
• Different tools/instruments used in livestock management	2
• Routine management practices followed on livestock farms	2
• Identification of feedstuffs and their nutritive value	2
• Nutritive requirement animals	1
• Computation of rations for livestock	2
• Study of housing systems and requirements	2
• Study of dairy farm records	2
• Analysis of milk for fat, acidity, total solids and specific gravity	2
• Preservation of fodder as hay ⁶ , silage and leaf meal.	2

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SAC-407 FERTILITY OF FOREST SOILS AND NUTRIENT MANAGEMENT
Cr. 3(2+1)

Theory

Forest soils – genesis – soil forming processes – podsolisation and laterization – genetic soil groups of the world – upland podzol – groud soils – melanized – laterite and lateritic, hydromorphic and embryonic soils – clayey and organic soils – nutrients – nutrient retention and distribution – diagnosis and correction of nutrient deficiencies. Fertilizers - manures – classification – macro, secondary and micronutrient fertilizers – reactions – method of application –recovery and residual effect of added fertilizers –efficient use of fertilizers- organic, inorganic and biofertilizers – integrated nutrient management (INM). Soil fertility evaluation – approaches, concepts, and application. Effect of forest fire on soil properties – physical, chemical and biological – management practices.

Practical

Estimation of pH and EC –Organic carbon –available N, P and K, Ca and Mg, S and micronutrients – Analysis of fertilizers: Ammonium nitrate, -super phosphate, rock phosphate, muriate of potash – manure analysis: Farm yard manure – Interpretation of soil and fertilizer analysis data for fertilizer recommendation.

Theory

Content	Lecture
• Forest soils – genesis – soil forming processes	2
• Podsolisation and laterization – genetic soil groups of the world – upland podzol – groud soils – melanized	4
• Laterite and lateritic, hydromorphic and embryonic soils – clayey and organic soils –	4
• Nutrients – nutrient retention and distribution – diagnosis and correction of nutrient deficiencies.	3
• Fertilizers - manures – classification – macro, secondary and micronutrient fertilizers	5
• Reactions – method of application –recovery and residual effect of added fertilizers	4
• Efficient use of fertilizers- organic, inorganic and biofertilizers	3
• Integrated nutrient management (INM).	2
• Soil fertility evaluation – approaches, concepts, and application.	3
• Effect of forest fire on soil properties – physical, chemical and biological – management practices	3

Practical

	Content	Lecture
•	Estimation of pH and EC –Organic carbon	3
•	Available N, P and K, Ca, Mg, S and micronutrients	5
•	Analysis of fertilizers: Ammonium nitrate, -super phosphate, rock phosphate	5
•	Muriate of potash – manure analysis	2
•	Farm yard manure – Interpretation of soil and fertilizer analysis data for fertilizer recommendation.	2

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MBMT-414 GENERAL AND FOREST MICROBIOLOGY Cr. 3(2+1)

Theory

Definition and scope of microbiology – spontaneous generation theory contributions of Antonie Van Leeuwenhoek, Louis, Pasteur John Tyndall , Robert Koch Joseph Lister, Winogradsky, Beijerinck, Fleming, Waksman and Frank Branches of microbiology. History of Forest Microbiology – scope and significance of Forest Microbiology - Microbiology - resolving power – numerical aperture, magnification – different types of microbiology and micrometry. Structure and organization of microbial cell : Prokaryotes and Eucaryotes, Various groups of microorganisms – bacteria , Fungi actinomycetes, algae, protozoa and viruses. Methods of isolation and purification . Types of nutritional media – sterilisation – principles of staining microorganisms. Preservation of microbial cultures. Nutritional types: autotroph, heterotroph, phototroph and chemolithotrophs. Requirements for growth- Temperature, pH and other factors. Growth curve of bacteria – continuous culture and synchronous culture. Microbial genetics – genetic elements in microorganism. Bacteriophages – lytic & lysogenic types – conjugation, transformation, transduction and mutation in bacteria. Principles of immunology. Industrially important microorganisms & their products microorganisms in various forest ecosystems – Isolation and enrichment methods Factors affecting microbial population in soil. Microbial decomposition of organic matter – organisms involved – carbon cycle – microbiology of composting methane and methanogenesis. Nitrogen fixation symbiotic and non - symbiotic or free living and associative types – Rhizobium tree legume symbiosis Frankia – non legume symbiosis – Nitrogen fixation –nitrification – denitrification. Microbial transformation of phosphorus – mycorrhizae – ecto and endomycorrhizae – Role of mycorrhizae in mobilization of macro and micronutrients role of mycorrhizae in afforestation of waste land. Tree rhizosphere and its importance – interrelationships between soil microorganisms – Associative antagonistic & symbiotic. Microbial transformation of iron and sulphur. Role of biofertilizers in afforestation – types of biofertilizers – bacterial biofertilizers – Rhizobium – Azospirillum , Azotobacter phosphobacteria – fungal biofertilizers and quality control .

Practical

Use and care of microscope – micrometry – sterilization techniques and equipment – preparation of culture. Isolation of microorganisms – aerobic and anaerobic forms. Enrichment culture technique. Purification techniques of microorganisms. Identification of microorganisms. Isolation of rhizosphere and non rhizosphere microorganisms. Isolation of Rhizobium from root nodules of tree legumes – study of root nodules of nonleguminous tree systems – Isolation of freeliving nitrogen fixers from soil – Isolation of Azospirillum and phosphobacteria – cultivation of mushrooms. Examination of ecto and endomycorrhizae from different forest soils – microbial inoculation techniques – biofertilizer inoculate production unit –mass culturing of mycorrhizae – storage methods – quality control.

Theory

	Content	Lecture
•	Definition and scope of microbiology – spontaneous generation theory contributions of Antonie Van Leeuwenhoek, Louis, Pasteur John Tyndall ,	3

Robert Koch, Joseph Lister, Winogradsky, Beijerinck, Fleming, Waksman and Frank Branches of microbiology.

- History of Forest Microbiology – scope and significance of Forest Microbiology - Microbiology - resolving power – numerical aperture, magnification – different types of microbiology and micrometry. 3
- Structure and organization of microbial cell : Prokaryotes and Eucaryotes, Various groups of microorganisms – bacteria , Fungi actinomycetes, lgae, protozoa and virous. Methods of isolation and purification. 3
- Types of nutritional media – sterilisation – principles of staining microirganisms. Preservation of microbial cultures. 2
- Nutritional types: autoroph, heterotroph, phototroph and chemolithotrophs. 2
- Requirements for growth- Temperature, pH and other factors. Growth curve of bacteria – continuous culture and syschrous culture. 2
- Microbial genetics – genetic elements in microorganism. Bacteriophages – lytic & lysogenic types – conjugation, transformation, transudation and mutation in bacteria. 3
- Principles of imunology. Industrially important microorganisms & their products microorganisms in various forest ecosystems – Isolation and enrichment methods Factors affecting microbial population in soil. 2
- Microbial decomposition of organic matter – organisms involed – carbon cycle – microbiology of compositing methane and methanogenesis. 3
- Nitrogen fixation symbiotic and non - symbiotic or free living and associative types – Rhizobium tree legume symbiosis Frankia – non legume symbiosis – Nitrogen fixation –nitrification – denitrification. 3
- Microbial transformation of phosphorus – mycorrhizae – ecto and endomycorrhizae – Role of mycorrhizae in mobilization of macro and micronutrients role of mycorrhizae in afforestation of waste land. 3
- Tree rhizosphere and its importance – interrelationships between soil microorranisms – Associative antagonistic & symbiotic. 2
- Microbial transformation of iron and sulphur. Role of biofertilizers in afforestation – types of biofertilizers – bacterial biofertilizers – Rhizobium – Azospirillum , Azotobacter phoshobacteria – fungal biofertilizers and quality control. 3

Practical

- | Content | Lecture |
|--|----------------|
| • Use and care of microscope – micrometry – sterilization techniques and equipment – preparation of culture. | 2 |
| • Isolation of microorganisms – aerobic and anaerobic forms. Enrichment | 3 |

- culture technique.
- Purification techniques of microorganisms. Identification of microorganisms. Isolation of rhizosphere and non rhizosphere microorganisms. 3
 - Isolation of Rhizobium from root nodules of tree legumes – study of root nodules of nonleguminous tree systems – Isolation of freeliving nitrogen fixers from soil – Isolation of Azospirillum and phosobacteria – cultivation of mushrooms. 4
 - Examination of ecto and endomycorrhizae from different forest soils – microbial inoculation techniques – biofertilizer inoculate production unit – mass culturing of mycorrhizae – storage methods – quality control. 5

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AGF-401 MEDICINAL AND AROMATIC PLANTS Cr. 2(1+1)

Theory

History, scope, opportunities and constraints in the cultivation and utilisation of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and aftercare, training and pruning, nutritional and water requirements. Plant protection, harvesting, processing and economics of under mentioned important medicinal and aromatic plants. Medicinal Plants : pepper, cardamom, clove, ginger, turmeric, betelvine, periwinkle, *Rauvolfia*, *Dioscorea*, isabgol, *Ammi majus*, belladonna, *Cinchona*, pyrethrum and other species relevant to local conditions. 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. Endangered medicinal and aromatic plants of India and their conservation. Study of chemical composition of a few important medicinal and aromatic plants, their extraction and use. Therapeutic and pharmaceutical uses of important species.

Practical:

Morphological description and identification of various medicinal plants. Collection of medicinal plants and plant parts from natural habitats. Survey and study of nursery techniques including training and pruning of medicinal plants. Harvesting, drying, grading, storage and processing techniques. Study of plant parts used in drug making. Visit to a nearby medicinal and aromatic plantation area /nursery /ayurvedic pharmacies /pharmaceutical industries.

Theory

Content	Lecture
• History, scope, opportunities and constraints in the cultivation and utilisation of medicinal and aromatic plants in India.	2
• Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and aftercare, training and pruning, nutritional and water requirements.	2
• Plant protection, harvesting, processing and economics of under mentioned important medicinal and aromatic plants.	2
• Medicinal Plants: pepper, cardamom, clove, ginger, turmeric, betelvine, periwinkle, <i>Rauvolfia</i> , <i>Dioscorea</i> , isabgol, <i>Ammi majus</i> , <i>belladonna</i> , <i>Cinchona</i> , <i>pyrethrum</i> and other species relevant to local conditions.	4
• Aromatic Plants: Citronella grass, khus grass, sweet flag (bach), lavender, geranium, patchouli, bursera, <i>Mentha</i> , muskdana (musk mallow), <i>Ocimum</i> and other species relevant to the local conditions.	3
• Endangered medicinal and aromatic plants of India and their conservation.	1
• Study of chemical composition of a few important medicinal and aromatic plants, their extraction and use.	2
• Therapeutic and pharmaceutical uses of important species.	1

Practical

	Content	Lecture
•	Morphological description and identification of various medicinal plants.	2
•	Collection of medicinal plants and plant parts from natural habitats.	2
•	Survey and study of nursery techniques including training and pruning of medicinal plants.	4
•	Harvesting, drying, grading, storage and processing techniques.	2
•	Study of plant parts used in drug making.	2
•	Visit to a nearby medicinal and aromatic plantation area /nursery /ayurvedic pharmacies /pharmaceutical industries.	5

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Theory

Introduction to Wood Anatomy. The plant body – Cell and organelles, meristems, promeristem, primary meristem, secondary meristem, apical and intercalary meristems. Simple tissues- parenchyma, collenchyma, sclerenchyma. Complex and vascular tissues. Anatomy of stems and roots of dicots and monocots. The secondary growth in woody plants. Mechanism of wood formation. Formation of early and late wood, growth rings, transformation of sapwood to heartwood. The macroscopic features of wood, bark- sapwood, heartwood, pith, growth rings, wood rays, resin or gum-canals. Cell inclusions. Physical properties of wood; colour, hardness, weight, texture, grain, lusture, etc. Abnormalities in wood -- deviation from typical growth form (leaning, bending, crook, fork, buttress), grain deviation, false and discontinuous growth rings. Reaction wood-compression and tension wood. Disruption of continuity of inner wood, shakes, included bark, resin pockets, pith flecks, knots (live and dead).

Practical:

Study of primary growth in typical dicot stem; Study of vascular bundles in monocots; Study of three dimensional features (cross, radial and tangential planes) of logs (woody trunks); Comparative anatomical features of softwoods and hardwoods; Study of gross features of different types of wood- straight, interlocked, spiral and wavy grain; texture; lusture; etc.; Study of anatomical features of different types of wood pores /vessels; Study of soft tissues in timbers and their distribution; Study of wood rays and their types; Study of non-porous woods, their physical and anatomical description; Study of cell inclusions in wood.

Theory

Content	Lecture
• Introduction to Wood Anatomy.	1
• The plant body – Cell and organelles, meristems, promeristem, primary meristem, secondary meristem, apical and intercalary meristems.	2
• Simple tissues- parenchyma, collenchyma, sclerenchyma.	1
• Complex and vascular tissues. Anatomy of stems and roots of dicots and monocots.	2
• The secondary growth in woody plants.	1
• Mechanism of wood formation.	1
• Formation of early and late wood, growth rings, transformation of sapwood to heartwood.	2
• The macroscopic features of wood, bark- sapwood, heartwood, pith, growth rings, wood rays, resin or gum-canals.	3
• Cell inclusions. Physical properties of wood; colour, hardness, weight, texture, grain, lusture, etc.	3
• Abnormalities in wood -- deviation from typical growth form (leaning, bending, crook, fork, buttress), grain deviation, false and discontinuous growth rings.	3
• Reaction wood-compression and tension wood.	1

- Disruption of continuity of inner wood, shakes, included bark, resin pockets, pith flecks, knots (live and dead). 1

Practical

Content	Lecture
• Study of primary growth in typical dicot stem.	1
• Study of vascular bundles in monocots	1
• Study of three dimensional features (cross, radial and tangential planes) of logs (woody trunks)	3
• Comparative anatomical features of softwoods and hardwoods	1
• Study of gross features of different types of wood- straight, interlocked, spiral and wavy grain; texture; lusture; etc.	3
• Study of anatomical features of different types of wood pores /vessels	2
• Study of soft tissues in timbers and their distribution	2
• Study of wood rays and their types	1
• Study of non-porous woods, their physical and anatomical description	2
• Study of cell inclusions in wood.	1

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NSS/NCC

SEMESTER – IV

ENV-416

ENVIRONMENTAL STUDIES - II

Cr. 2(2+0)

Theory

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. (e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. (f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification- Role of an individual in conservation of natural resources.-Equitable use of resources for sustainable lifestyles. Biodiversity and its conservation-Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India-Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values-Biodiversity at global, national and local levels-India as a mega-diversity nation-Hot-spots of biodiversity-Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts-Endangered and endemic species of India-Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental Pollution-Definition-Causes, effects and control measures of: Air pollution-Water pollution- Soil pollution-Marine pollution- Noise pollution- Thermal pollution- Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studie. Disaster management: floods, earthquake, cyclone and landslides

Theory

	Lectures
• Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.	1
• Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.	1
• Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.	1
• Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.	1
• Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.	1

- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. 2
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. 1
- Role of an individual in conservation of natural resources. 1
- Equitable use of resources for sustainable lifestyles. 1
- Biodiversity and its conservation-Introduction – Definition: genetic, species and ecosystem diversity 1
- Biogeographical classification of India 1
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values 1
- Biodiversity at global, national and local levels 1
- India as a mega-diversity nation 1
- Hot-spots of biodiversity 1
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts 1
- Endangered and endemic species of India 1
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity 1
- Environmental Pollution-Definition 1
- Causes, effects and control different pollutions 1
- Air pollution 1
- Water pollution 1
- Soil pollution 1
- Marine pollution 1
- Noise pollution 1
- Thermal pollution 1
- Nuclear pollution 1
- Solid waste management: Causes, effects and control measures of urban and industrial wastes. 1
- Role of an individual in prevention of pollution 1
- Pollution case studies 1
- Disaster management: floods, earthquake, cyclone and landslides 2

Reference:

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Theory

Indian agriculture its structure and constraints. Land use definition, classification and planning. Agroforestry - definition, aims, objectives and need. Traditional agroforestry systems: Taungya system, Shifting cultivation, wind break, shelterbelts, Homestead gardens'. Alley cropping, high density short rotation plantation systems, silvicultural woodlots/energy plantations. Classification of agroforestry system -structural, functional, socio-economic and ecological basis. Multipurpose tree species and their characteristics. Tree architecture, canopy management - lopping, pruning, pollarding and hedging. Diagnosis and design. Agroforestry systems in different agroclimatic zones, components, production and management techniques. Nutrient cycling, soil conservation, watershed management and climate change mitigation. Economics of agroforestry systems. People participation, rural entrepreneurship through agroforestry and industrial linkages. Analysis of fodder and fuel characteristics of tree/shrubs. Financial and socio-economic analysis of agroforestry systems. Social forestry in Uttar Pradesh – components targets and achievements. Wastelands - definition, extent and classification - suitable tree species for acid saline, sodic, lateritic calcareous sandy, shallow, water logged and mine spoiled soils – methods of sand dune stabilization – Agroforestry for coastal and hilly areas.

Practical:

Study characteristics of trees/shrubs/grasses for agroforestry. Volume and biomass estimation. Crown measurement, light interception and moisture measurement in agroforestry systems. Annual crops/grass growth measurements and yield estimation. Analysis of soil and plant samples for organic carbon N,P and K. Diagnosis and design - methodology. Survey agroforestry practices in local/ adjoining areas. Description of intercropping, alley cropping and mixed woodlot systems – resource sharing efficiency of different tree species – allelopathic effect of different tree species – diagnostic survey in a nearby village – exercise in designing a shelterbelt – documentation and description of different fodder trees in the locality –Recording components of a social forestry plantation – management prescriptions for Agave –assessment of people's participation in social forestry project –detailed description of Agroforestry systems adopted in the Uttar Pradesh area – methodology for sand dune stabilization.

Theory

Content	Lecture
• Indian agriculture - its structure and constraints.	1
• Land use definition, classification and planning.	1
• Agroforestry - definition, aims, objectives and need.	1
• Traditional agroforestry systems: Taungya system, Shifting cultivation, wind break, shelterbelts, Homestead gardens'.	1
• Alley cropping, high density short rotation plantation systems, silvicultural woodlots/energy plantations.	2
• Classification of Agroforestry system -structural, functional, socio-economic and ecological basis.	1
• Multipurpose tree species and their characteristics.	1

- Tree architecture, canopy management - lopping, pruning, pollarding and hedging, Diagnosis and design. 1
- Agroforestry systems in different agroclimatic zones, components, production and management techniques. 1
- Nutrient cycling, soil conservation, watershed management and climate change mitigation, Economics of agroforestry systems. 1
- People participation, rural entrepreneurship through agroforestry and industrial linkages. 1
- Analysis of fodder and fuel characteristics of tree/shrubs. 1
- Financial and socio-economic analysis of agroforestry systems, Social forestry in Uttar Pradesh, components targets and achievements. 1
- Wastelands - definition, extent and classification 1
- suitable tree species for acid saline, sodic, lateritic calcareous sandy, shallow, water logged and mine spoiled soils 1
- methods of sand dune stabilization, Agroforestry for coastal and hilly areas. 1

Practical

Content	Lecture
• Study characteristics of trees/shrubs/grasses for agroforestry.	1
• Volume and biomass estimation.	1
• Crown measurement, light interception and moisture measurement in agroforestry systems.	1
• Annual crops/grass growth measurements and yield estimation.	1
• Analysis of soil and plant samples for organic carbon N,P and K.	1
• Diagnosis and design	1
• Methodology. Survey agroforestry practices in local/ adjoining areas.	1
• Description of intercropping, alley cropping and mixed woodlot systems	1
• Resource sharing efficiency of different tree species	1
• Allelopathic effect of different tree species	1
• Diagnostic survey in a nearby village	1
• Exercise in designing a shelterbelt	1
• Documentation and description of different fodder trees in the locality	1
• Recording components of a social forestry plantation	1
• Management prescriptions for Agave	1
• Assessment of people's participation in social forestry project	1
• Detailed description of Agroforestry systems adopted in the Uttar Pradesh area – methodology for sand dune stabilization.	1

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Theory

Origin, distribution, general description, phenology, silvicultural characters, regeneration methods, silvicultural systems and economic importance of the following conifer and broadleaved tree species of India. Conifers: *Abies pindrow*, *Picea smithiana*, *Cedrus deodara*, *Pinus roxburghii*, *Pinus wallichiana*, *P. gerardiana* and *Juniperus macropoda*. Broad leaved species: *Tectona grandis*, *Shorea robusta*, *Acacia spp.*, *Dalbergia sissoo*, *D latifolia*, *Quercus spp.* *Robinia pseudoacacia*, *Alnus spp.* *Anogeissus spp.* *Populus spp.*, *Eucalyptus spp.* *Casuarina equisetifolia*, *Terminalia spp.*, *Santalum album*, *Swietenia mahagony*, *Albizia spp.* *Prosopis spp.* *Pterocarpus santalinus*, *Azadirachta indica*, *Diospyros melanoxylon*, *Madhuca indica*, *Leucaena leucocephala* and Bamboos.

Practical:

Study of species composition in surrounding areas. Study of morphology and phenology of tree species growing in the area. Study of artificial regeneration of Pines, Bamboo, Oak, *Dalbergia sissoo* and *Acacia catechu*, etc. Practicing thinning in Bamboo clumps. Study on tree responses to the abiotic and biotic factors viz., light, fire, drought, frost, root suckering, coppicing and pollarding, etc. To study quality characters of nursery planting stock.

Theory

Content	Lecture
• Origin, distribution, general description, phenology.	1
• Silvicultural characters, regeneration methods	1
• Silvicultural systems and economic importance of the following Conifers: <i>Abies pindrow</i> , <i>Picea smithiana</i> , <i>Cedrus deodara</i> , <i>Pinus roxburghii</i> ,	3
• Silvicultural systems and economic importance of the following conifer <i>Pinus wallichiana</i> , <i>P. gerardiana</i> and <i>Juniperus macropoda</i> .	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. <i>Tectona grandis</i> , <i>Shorea robusta</i> , <i>Acacia spp.</i> ,	4
• Silvicultural systems and economic importance of the following broadleaved tree species of India. <i>Dalbergia sissoo</i> , <i>D latifolia</i> , <i>Quercus spp.</i>	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. <i>Robinia pseudoacacia</i> , <i>Alnus spp.</i> <i>Anogeissus spp.</i>	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. <i>Populus spp.</i> , <i>Eucalyptus spp.</i> <i>Casuarina equisetifolia</i> ,	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. <i>Terminalia spp.</i> , <i>Santalum album</i> , <i>Swietenia mahagony</i> ,	4
• Silvicultural systems and economic importance of the following broadleaved tree species of India. <i>Albizia spp.</i> , <i>Prosopis spp.</i> <i>Pterocarpus santalinus</i> ,	3

- Silvicultural systems and economic importance of the following broadleaved tree species of India. *Azadirachta indica*, *Diospyros melanoxylon*, *Madhuca indica*, 3
- Silvicultural systems and economic importance of the following broadleaved tree species of India. *Leucaena leucocephala* and Bamboos. 3

Practical

Content	Lecture
• Study of species composition in surrounding areas.	2
• Study of morphology and phenology of tree species growing in the area.	2
• Study of artificial regeneration of Pines, Bamboo, Oak, <i>Dalbergia sisoo</i> and <i>Acacia catechu</i> , etc.	4
• Practicing thinning in Bamboo clumps.	2
• Study on tree responses to the abiotic and biotic factors viz., light, fire, drought, frost, root suckering, coppicing and pollarding, etc.	5
• To study quality characters of nursery planting stock.	2

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FBL-403 FUNDAMENTALS OF WILDLIFE & FOREST TRIBES Cr. 3(2+1)

Theory

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 of the world. India's uniqueness in biodiversity, reasons and causes of wildlife depletion. Biogeographic classification of India. Status and distribution of wildlife in India. Scientific and common names of important mammals, birds and reptiles. Rare, endangered and threatened species of mammals, birds and reptiles of India. Agencies involved in wildlife conservation, Govt. and NGO's. BNHS, WWF, Indian Board for wildlife, CITES. Biological basis of wildlife management. Basic requirements of wildlife –food, water, cover and space, limiting factors. Wildlife ecology : Relevance of basic ecological concepts such as foodchain, foodweb, ecological pyramids, habitat, ecological niche, carrying capacity, density, prey-predator relations and population dynamics.

Forest tribes and tribal societies – forest tribal scheme in India – demography of forest tribes in India – characteristics of forest tribal regions -important forest tribal communities of India – primitive forest tribals – major forest tribal communities – socio – cultural characteristics – traditional beliefs – values – norms – customs – taboos – changing trends in life style – social structure – emergence of leadership – social movements- administration of tribals – reports and recommendation of various committees formed for the forest tribal welfare and administration- problems and integration in the mainstream. Forest tribal welfare programmes – genesis and growth – efforts by government and voluntary agencies- ongoing forest tribal development programmes – components, approaches and impact – enforcement of forest laws – involving tribes in forest development activities.

Practical:

Study on evolution of organisms – Geological time table - Animal nomenclature - class Pisces – features – important orders class amphibia – characters- important order class Reptilia – behaviour – orders. Class Aves –characters – important orders - Class Mammalia – features – orders. Collection and preservation of biological specimens. Farmal inventorying and bird/ animal watching.

Theory

	Content	Lecture
•	Definition of wildlife, free living, captive, domesticated and feral animals.	1
•	Justification of wildlife conservation, uses, values and negative impact of wildlife.	2
•	Zoogeographic regions and biomes of the world.	1
•	India's uniqueness in biodiversity, reasons and causes of wildlife depletion.	1
•	Biogeographic classification of India.	1
•	Status and distribution of wildlife in India.	1
•	Scientific and common names of important mammals, birds and reptiles.	2
•	Rare, endangered and threatened species of mammals, birds and reptiles of	2

India. Agencies involved in wildlife conservation, Govt. and NGO's.	
• BNHS, WWF, Indian Board for wildlife, CITES.	2
• Biological basis of wildlife management.	1
• Basic requirements of wildlife –food, water, cover and space, limiting factors.	3
• Wildlife ecology: Relevance of basic ecological concepts such as foodchain, foodweb, ecological pyramids, habitat, ecological niche, carrying capacity, density, prey-predator relations and population dynamics.	3
• Forest tribes and tribal societies – forest tribal scheme in India – demography of forest tribes in India – characteristics of forest tribal regions	2
• Important forest tribal communities of India – primitive forest tribals – major forest tribal communities – socio – cultural characteristics – traditional beliefs – values – norms – customs – taboos – changing trends in life style – social structure – emergence of leadership –social movements-administration of tribals	4
• Reports and recommendation of various committees formed for the forest tribal welfare and administration	2
• Problems and integration in the mainstream. Forest tribal welfare programmes. Genesis and growth	2
• Efforts by government and voluntary agencies. Ongoing forest tribal development programmes. Components, approaches and impact	2
• Enforcement of forest laws .Involving TRIBES in forest development activities.	2

Practical

Content	Lecture
• Study on evolution of organisms	2
• Geological time table	2
• Animal nomenclature, Class Pisces, Features	2
• Important orders class amphibia	1
• Characters- important order class Reptilia	1
• Behaviour – orders.	2
• Class Aves –characters – important orders	1
• Class Mammalia – features – orders.	1
• Collection and preservation of biological specimens.	2
• Farmal inventorying and bird/ animal watching.	3

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Theory

Wood as raw material, kinds of woods– hardwood, softwood; bamboos and canes. Merits and demerits of wood as raw material. The physical features of wood. Mechanical properties of wood like tension, compression, bending, shearing cleavage, hardness, impact resistance, nail and screw holding capacities. Suitability of wood for various uses based on mechanical and physical properties. Electrical and acoustic properties of wood. Wood water relationship – shrinkage, swelling, movement, fibre saturation, equilibrium moisture content. Wood seasoning – merits, principles and types – air seasoning, kiln seasoning and chemicals seasoning. Refractory classes of timbers, kiln schedules. Seasoning defects and their control. Wood preservation – principles, processes, need, types of wood preservatives (Water soluble, oil based, etc.), Classification of timbers based on durability. General idea about fire retardants and their usage. Non-pressure methods – steeping, dipping, soaking open tank process, Boucherie process. Pressure methods – full cell process, empty cell process (Lowry and Rueping). Wood machining. Sawing – techniques, kinds of saws – cross cut, edging, cudless, hand, circular and bow saws. Wood working, tools used in wood working (parting, slicing, shaping, measuring and marking tools). Various stages in wood working. Dimensional stabilization of wood by surface coating method, bulking method, impregnation of resins and polymers.

Practical:

Different kinds and types of wood available as raw material. Parts of logs, other wooden raw materials and preliminary idea regarding procurement and temporary storage. Preliminary idea regarding conversion and milling. Estimation of moisture content and density of wood by oven dry method and by moisture meters. Seasoning of timber, air seasoning, kiln seasoning etc. Seasoning defects and their remedies. Testing of mechanical properties of wood. Woodworking, tools used and various stages and types of joints in wooden members, wooden fasteners, dowels, carving, sanding etc. Polishing and finishing of wood. Surface coating applications and wood primers. Wood preservatives. Chemicals used and methods of wood preservation and fire retardant treatments.

Theory

Content	Lecture
• Wood as raw material, kinds of woods	1
• Hardwood, softwood; bamboos and canes.	1
• Merits and demerits of wood as raw material.	1
• The physical features of wood.	1
• Mechanical properties of wood like tension, compression, bending, shearing cleavage, Hardness, impact resistance, nail and screw holding capacities.	3
• Suitability of wood for various uses based on mechanical and physical properties.	2
• Electrical and acoustic properties of wood.	1
• Wood water relationship	1
• Shrinkage, swelling, movement, fibre saturation, equilibrium moisture content.	2
• Wood seasoning – merits, principles and types	1

• Air seasoning, kiln seasoning and chemicals seasoning.	1
• Refractory classes of timbers, kiln schedules.	1
• Seasoning defects and their control.	1
• Wood preservation – principles, processes, need, types of wood preservatives (Water soluble, oil based, etc.),	2
• Classification of timbers based on durability.	1
• General idea about fire retardants and their usage.	1
• Non-pressure methods – steeping, dipping, soaking open tank process, Boucherie process.	2
• Pressure methods – full cell process, empty cell process (Lowry and Rueping).	2
• Wood machining.	1
• Sawing – techniques, kinds of saws	1
• Cross cut, edging, cudless, hand, circular and bow saws.	1
• Wood working, tools used in wood working (parting, slicing, shaping, measuring and marking tools).	2
• Various stages in wood working.	1
• Dimensional stabilization of wood by surface coating method, bulking method, Impregnation of resins and polymers.	3

Practical

Content	Lecture
• Different kinds and types of wood available as raw material.	1
• Parts of logs, other wooden raw materials and preliminary idea regarding procurement and temporary storage.	2
• Preliminary idea regarding conversion and milling.	1
• Estimation of moisture content and density of wood by oven dry method and by moisture meters.	2
• Seasoning of timber, air seasoning, kiln seasoning etc.	1
• Seasoning defects and their remedies.	1
• Testing of mechanical properties of wood.	1
• Woodworking, tools used and various stages and types of joints in wooden members,	2
• Wooden fasteners, dowels, carving, sanding etc.	1
• Polishing and finishing of wood.	1
• Surface coating applications and wood primers.	1
• Wood preservatives.	1
• Chemicals used and methods of wood preservation and fire retardant treatments.	2

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SAC-508 FOREST SOIL SURVEY, LAND USE & REMOTE SENSING

Cr. 3(2+1)

Theory:

Scope and objective; soil survey, sampling methods; planning, inventory, permanent sample plots; sample size allocation, landuse classes and planning. Aerial photography and remote sensing-definition, meaning, scope, merits and brief history. Electromagnetic spectrum; radiations, differential reflections by surfaces, active and passive remote sensing, earth observation satellites. Equipment and materials-aerial bases, cameras, filters, stereoscopes, computers, radars. Photogrammetry: Vertical and oblique photography. Photographs and images, scales, resolution, photo interpretation, photogrammetry, image analysis, mapping. Agencies involved in remote sensing and acquiring information from them. Remote sensing; principles, uses in forestry, status monitoring, fire, vegetation/cover classification and mapping, species identification, height and volume – estimation. Identification of tree species and their form stand delineation. Interpretation of land forms and soils; use of micro-level survey of farm forests, large scale photos in forest inventory, site selection. Imagery and image analysis – video satellite, computer and radars. Geographic Information systems- Computer softwares used. Characterization of wasteland, present status and extent of nonarable lands and their productivity. Salt affected soils, lateritic, marsh and swampy and rocky hills, rocky plains, murrummy and sandy soils, their characteristics and reclamation. Sites with superficial impervious hard pan. Eroded ravines and gullies, various techniques of afforestation of adverse sites, trees suitable for adverse sites. Afforestation and reclamation of mine wastes. Stabilization of tailing dumps and prevention of dust pollution. Sewage water as source of tree nutrients.

Practical:

Exercise on sampling methods; Exercises on land use classes; Exercises on lightspectral characteristics; Study of equipment and materials used in aerial photography and remote sensing; Study of scales; Case studies-aerial photography and satellite imageries; Case studies – Geographic Information System – application in forestry; Computer software used in GIS; Analysis of soil for Gypsum and lime requirement; Exercises on study of eroded soils; Study on types of pits and trenches, tree species suitable for mined out areas; Visit to nearest mined areas.

Theory

Content	Lecture
• Scope and objective; soil survey.	1
• Sampling methods; planning, inventory, permanent sample plots; sample size allocation, Landuse classes and planning.	2
• Aerial photography and remote sensing-definition, meaning, scope, merits and brief history.	2
• Electromagnetic spectrum; radiations, differential reflections by surfaces, active and passive remote sensing, earth observation satellites.	3
• Equipment and materials-aerial bases, cameras, filters, stereoscopes, computers, radars. Photogrammetry.	2

• Vertical and oblique photography.	1
• Photographs and images, scales, resolution, photo interpretation, photogrammetry, image analysis, mapping.	2
• Agencies involved in remote sensing and acquiring information from them.	2
• Remote sensing; principles, uses in forestry, status monitoring, fire, vegetation/cover Classification and mapping,	2
• Species identification.	1
• height and volume – estimation.	1
• Identification of tree species and their form stand delineation.	1
• Interpretation of land forms and soils; use of micro-level survey of farm forests.	2
• large scale photos in forest inventory, site selection.	1
• Imagery and image analysis – video satellite, computer and radars.	1
• Geographic Information systems- Computer softwares used.	1
• Characterization of wasteland, present status and extent of nonarable lands and their productivity.	2
• Salt affected soils, lateritic, marsh and swampy and rocky hills, rocky plains, murrummy and sandy soils, their characteristics and reclamation.	3
• Sites with superficial impervious hard pan.	1
• Eroded ravines and gullies, various techniques of afforestation of adverse sites, trees suitable for adverse sites.	2
• Afforestation and reclamation of mine wastes.	1
• Stabilization of tailing dumps and prevention of dust pollution.	1
• Sewage water as source of tree nutrients.	1

Practical

Content	Lecture
• Exercise on sampling methods	1
• Exercises on land use classes	1
• Exercises on light spectral characteristics	1
• Study of equipment and materials used in aerial photography and remote sensing	2
• Study of scales	1
• Case studies-aerial photography and satellite imageries	2
• Case studies – Geographic Information System – application in forestry	1
• Computer software used in GIS	2
• Analysis of soil for Gypsum and lime requirement	2
• Exercises on study of eroded soils	1
• Study on types of pits and trenches	1
• Tree species suitable for mined out areas	1
• Visit to nearest mined areas	1

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SVC-404 NURSERY MANAGEMENT AND SEEDLING PRODUCTION

Cr. 2(1+1)

Theory

Propagation concept, definition, methods and importance. Site selection, planning and layout of nursery area. Types of nursery, types of nursery beds, preparation of beds. Pre-sowing treatments. Methods of seed sowing. pricking. watering methods, weeding, hoeing, fertilization, shading, root culturing techniques, lifting windows, grading, packaging. Storing and transportation. Type and size of containers. Merits and demerits of containerized nursery. Preparation of ingredient mixture. Vegetative propagation techniques - macro and micropropagation. Study of important nursery pests and diseases and their control measures. Nursery practices for some important tree species.

Practical:

Preparation of production and planning schedule for bareroot and containerized nurseries. Nursery site and bed preparation. Pre-sowing treatments. Sowing methods of small, medium and large sized seeds. Pricking and transplanting of pricked out stock within nursery in transplant beds. Intermediate nursery management operations. Preparation of ingredient mixture. Filling of containers. Study of vegetative techniques – cutting, grafting etc. Visit to tissue culture laboratory and other nurseries.

Theory

Content	Lecture
• Propagation concept, definition, methods and importance.	1
• Site selection, planning and layout of nursery area.	1
• Types of nursery, types of nursery beds, preparation of beds.	2
• Pre-sowing treatments	1
• Methods of seed sowing. Pricking, watering methods, weeding, hoeing, fertilization, shading	2
• Root culturing techniques, lifting windows, grading, packaging. Storing and transportation.	2
• Type and size of containers.	1
• Merits and demerits of containerized nursery.	1
• Preparation of ingredient mixture.	1
• Vegetative propagation techniques - macro and micro-propagation.	2
• Study of important nursery pests and diseases and their control measures.	2
• Nursery practices for some important tree species.	1

Practical

Content	Lecture
• Preparation of production and planning schedule for bareroot and containerized nurseries.	2
• Nursery site and bed preparation.	2
• Pre-sowing treatments.	1
• Sowing methods of small, medium and large sized seeds.	1
• Pricking and transplanting of pricked out stock within nursery in transplant beds.	3

- Intermediate nursery management operations. 2
- Preparation of ingredient mixture. 1
- Filling of containers. 1
- Study of vegetative techniques – cutting, grafting etc. 2
- Visit to tissue culture laboratory and other nurseries. 2

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MAS-417 STATISTICAL METHODS & DESIGNS OF EXPERIMENTS

Cr. 3(2+1)

Theory

1. Definition and application of statistics
2. Classification and tabulation of data
3. Measures of central tendency
4. Measures of dispersion (Standard deviation, Mean deviation Coefficient of variation, standard error.)
5. Elementary idea of probability
6. Normal distribution
7. Test of signification:
 - X^2 – test (2X 2 contingency table only)
 - T - test (One sample t- test only)
 - F – test (definition)
8. Designs of Experiments (All designs)
9. Analysis of variance
10. Regression, Correlation, analysis covariance.
11. Basic principles of experimental design.

Practical:

1. Measures of location.
2. Measures of dispersion.
3. X^2 . t – tests.
4. C.R.D. and R.B.D.

Theory

Content	Lecture
• Definition and application of statistics	2
• Classification and tabulation of data	2
• Measures of central tendency	2
• Measures of dispersion (Standard deviation, Mean deviation Coefficient of variation, standard error.)	3
• Elementary idea of probability	2
• Normal distribution	2
• Test of signification:	2
• X^2 – test (2X ² contingency table only)	2
• T - test (One sample t- test only)	2
• F – test (definition)	2
• Designs of Experiments (All designs)	4
• Analysis of variance	2
• Regression, Correlation, analysis covariance.	3
• Basic principles of experimental design.	4

Practical

	Content	Lecture
•	Measures of location.	3
•	Measures of dispersion.	3
•	X^2 and t – tests.	4
•	C.R.D.	3
•	R.B.D.	4

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13. G.W. Snedecor and W.G. Cochran, Statistical Methods.
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SEMESTER – V

AGF-501 FOREST UTILIZATION –I (Timber & Forest Products) Cr. 3(2+1)

Theory:

Pulp and paper industry. Introduction and raw material; pulping-mechanical, chemical, semichemical and semi-mechanical; pulp bleaching; stock preparation and sheet formation; types of paper; manufacture of rayon and other cellulose derived products. Manufacture, properties and uses of Composite wood- plywood, fiberboard, particleboard and hard board. Adhesives used in manufacture of composite wood. Improved wood-definition, types (impregnated wood, heat stabilized wood, compressed wood, and chemically modified wood). Destructive distillation of wood. Saccharification of wood. Production of wood molasses, alcohol and yeast. Techno – economic status and suitability of Indian timbers for various purposes Timber Grading – Scope and purpose of grading – Present systems of grading – practices in measurements and calculation in India. Measurement and evolution of defects in grading– Machine grading– Economy due to grading– systems of extraction and disposal. Structural uses of Timber – bridges and other super structures – Decorative uses of wood – specialised uses of wood – agricultural implements – aircraft timber industry Bearings, bent wood articles – Boot last shoe heel, Boxes, crates, packing cases, brushes, brooms, carts, carriage, cooperage, engraving and printing blocks, excelsior, fence post, piles, furniture and paneling, Match boxes and splints mathematical and musical instruments etc.

Practical:

Visit to paper industry to study pulp and papermaking. Study of different types of papers. Study of different types of paper boards. Visit to Rayon industry. Visit to plywood industry to study the manufacturing processes. Study of plywood, fiberboards, particleboards, and hard boards. Visit to other wood based industries. Visit to wood distillation unit. Visit to nearby industrial plantations. Study of types of improved wood. Grading of timber – Visual methods of stress grading. Systems of extraction and disposal –Visit to various timber depots in U.P. study on structural uses of timber study on Decorative and specialized uses of timber – Study on Composite and improved wood – Visit to paper industry – Visit to wood working industry.

Theory

	Content	Lecture
•	Pulp and paper industry.	1
•	Introduction and raw material;	2
•	Pulping-mechanical, chemical, semichemical and semi-mechanical;	2
•	Pulp bleaching; stock preparation and sheet formation;	2
•	Types of paper;	1
•	Manufacture of rayon and other cellulose derived products.	2
•	Manufacture, properties and uses of Composite wood- plywood, fiberboard, particleboard and hard board.	2
•	Adhesives used in manufacture of composite wood.	1

• Improved wood-definition, types (impregnated wood, heat stabilized wood, compressed wood, and chemically modified wood).	2
• Destructive distillation of wood.	1
• Saccharification of wood.	2
• Production of wood molasses, alcohol and yeast.	1
• Techno – economic status and suitability of Indian timbers for various purposes	2
• Timber Grading – Scope and purpose of grading – Present systems of grading	2
• Practices in measurements and calculation in India.	1
• Measurement and evolution of defects in grading– Machine grading	1
• Economy due to grading– systems of extraction and disposal.	1
• Structural uses of Timber – bridges and other super structures	2
• Decorative uses of wood – specialised uses of wood – agricultural implements – aircraft timber industry Bearings, bent wood articles	2
• Boot last shoe heel, Boxes, crates, packing cases, brushes, brooms, carts, carriage, cooperage, engraving and printing blocks, excelsior, fence post, piles, furniture and paneling,	3
• Match boxes and splints mathematical and musical instruments etc.	1

Practical

Content	Lecture
• Visit to paper industry to study pulp and papermaking.	1
• Study of different types of papers.	1
• Study of different types of paper boards.	1
• Visit to Rayon industry.	1
• Visit to plywood industry to study the manufacturing processes.	1
• Study of plywood, fiberboards, particleboards, and hard boards.	1
• Visit to other wood based industries.	1
• Visit to wood distillation unit.	1
• Visit to nearby industrial plantations.	1
• Study of types of improved wood.	1
• Grading of timber – Visual methods of stress grading.	1
• Systems of extraction and disposal	1
• Visit to various timber depots in U.P.	1
• Study on structural uses of timber study on Decorative and specialized uses of timber –	1
• Study on Composite and improved wood	1
• Visit to paper industry	1
• Visit to wood working industry.	1

References

1. Anonymous. 1976. Indian forest utilization. Volume I and IIICFRE Publication, Dehradun.

2. Mehta, T. 1981. A handbook of forest utilization. Periodical Expert Book Agency, Delhi. 298 p.
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4. Trotter, H. 1982. Indian forest utilisation, Forest Research Institute and Colleges, Dehradun.
5. Wadoo, M.S. 1992. Utilization of forest resources. Idris Publi. Srinagar 252 p.

Theory:

History of wildlife management and conservation in India; cultural background. Habitat management: Purposes, principles, practices and tools-fire, cutting, grazing. Habitat interspersions and edge effect. Provision of water, saltlicks and food. Zoning – core, buffer, tourism and multiple use in protected areas. Wildlife damage control : Mitigating human – wildlife conflict: fences, trenches, walls, lure crops, repellents, translocation and compensation. Captive wildlife : Zoos and safari parks. Captive breeding for conservation. Central Zoo Authority of India. Wildlife census : Purpose, techniques. Direct and indirect methods of population estimation. Sample and total counts, indices, encounter rates and densities. Wildlife (Protection) Act, 1972. Protected areas – Sanctuary, National Park and Biosphere Reserves. Special projects for wildlife conservation. Project Tiger and Musk Deer Project. Introduction and reintroduction of species. Wildlife corridors. MAB, Red Data Book, Category of threat, CITES. Conservation : Meaning, principles and strategies, in-situ and exsitu conservation, conserving biodiversity. Politics-socioeconomics, role of education and extension. Project elephant - Himalayan musk deer project - Gir Lion Project. Biosphere Reserves (BR) – concepts – importance's – components and management – BR in India – UNESCO – MAB.

Practical:

Field/laboratory studies of distinct and characteristics morphological and other features of fishes, reptiles, birds and mammals. Identification and study of wildlife in a nearby zoo. Bird watching : Preparation of inventory of an area. Direct and indirect methods of studying food habits of different wildlife. Studying habitat management and manipulation techniques. Wildlife damage and control: Questionnaire survey. Visit to wildlife sanctuaries, National Parks and Zoological parks in Uttar Pradesh - Wildlife damage – health management Zoonotic diseases - Planning and management of National Park and Sanctuary - studies on captive wildlife - methods of capture – taming and training.

Theory

Content	Lecture
• History of wildlife management and conservation in India; cultural background.	2
• Habitat management: Purposes, principles, practices and tools-fire, cutting, grazing.	2
• Habitat interspersions and edge effect.	1
• Provision of water, saltlicks and food.	1
• Zoning – core, buffer, tourism and multiple use in protected areas.	2
• Wildlife damage control :	1
• Mitigating human – wildlife conflict: fences, trenches, walls, lure crops, repellents, translocation and compensation.	2

• Captive wildlife : Zoos and safari parks.	2
• Captive breeding for conservation.	1
• Central Zoo Authority of India.	1
• Wildlife census : Purpose, techniques. Direct and indirect methods of population estimation. Sample and total counts, indices, encounter rates and densities.	3
• Wildlife (Protection) Act, 1972.	2
• Protected areas – Sanctuary, National Park and Biosphere Reserves. Special projects for wildlife conservation.	2
• Project Tiger and Musk Deer Project.	2
• Introduction and reintroduction of species.	1
• Wildlife corridors. MAB, Red Data Book, Category of threat, CITES.	2
• Conservation : Meaning, principles and strategies, in-situ and exsitu conservation, conserving biodiversity.	2
• Politics-socioeconomics, role of education and extension.	1
• Project elephant - Himalayan musk deer project - Gir Lion Project.	1
• Biosphere Reserves (BR) – concepts – importance's – components and management	2
• BR in India – UNESCO – MAB.	1

Practical

Content	Lecture
• Field/laboratory studies of distinct and characteristics morphological and other features of fishes, reptiles, birds and mammals.	2
• Identification and study of wildlife in a nearby zoo.	1
• Bird watching :	2
• Preparation of inventory of an area.	1
• Direct and indirect methods of studying food habits of different wildlife. Studying habitat management and manipulation techniques.	2
• Wildlife damage and control:	2
• Questionnaire survey.	1
• Visit to wildlife sanctuaries, National Parks and Zoological parks in Uttar Pradesh –	2
• Wildlife damage – health management Zoonotic diseases	1
• Planning and management of National Park and Sanctuary	1
• Studies on captive wildlife - methods of capture – taming and training.	2

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9. Sharma, B.D. 1999. Indian wildlife resources: Ecology and development. Daya Publishing House, Delhi.

Theory

Introduction, history and development of tree improvement, its relation to other disciplines for forest management. Reproduction in forest trees – anthesis and pollination – their importance in tree breeding. Quantitative inheritance, heritability, genetic advance, genetic gain, combining ability and their application. Genetic, environmental and phenotypic expression of trees. Genetic basis of tree breeding and selection practices in forest trees. Patterns of environmental variation- species and provenance trials in forest trees. Seed stands (seed production areas) Plus tree selection, progeny trials and Location, management and establishment of seed orchard. Genetic consequences of hybridization. Back cross breeding, heterosis breeding, breeding for resistance to insect pest, diseases, air pollution and for wood properties. Conservation of forest tree germplasm. Recent techniques in tree improvement. Vegetative propagation and tree improvement.

Practical

Floral biology & phonological observations in some important species. Estimation of pollen sterility and viability. Emasculation & hybridization in self pollinated species. Emasculation & hybridization in cross pollinated species. Different breeding methods-flow chart. Species and provenance selection techniques. Recording observation in provenance trial of some important species-recording variation & working out coefficient of variation. Sampling in seed collection. Recording stand density in seed stands, seed output; season of seed collection. Vegetative propagation techniques and tree improvement. Estimation of phenotypic and genotypic coefficient of variation. Estimation of genetic advance, heritability and GCA. Exercise in plus-tree selection. Seed orchard designs.

Theory

Content	Lecture
• Introduction, history and development of tree improvement, its relation to other disciplines for forest management.	2
• Reproduction in forest trees – anthesis and pollination – their importance in tree breeding.	4
• Quantitative inheritance, heritability, genetic advance, genetic gain, combining ability and their application.	3
• Genetic, environmental and phenotypic expression of trees.	3
• Genetic basis of tree breeding and selection practices in forest trees.	2
• Patterns of environmental variation- species and provenance trials in forest trees.	2
• Seed stands (seed production areas) Plus tree selection, progeny trials and Location, management and establishment of seed orchard.	4
• Genetic consequences of hybridization.	2
• Back cross breeding, heterosis breeding, breeding for resistance to insect pest, diseases, air pollution and for wood properties.	4
• Conservation of forest tree germplasm.	2
• Recent techniques in tree improvement.	3
• Vegetative propagation and tree improvement.	3

Practical

Content	Lecture
• Floral biology & phenological observations in some important species.	1
• Estimation of pollen sterility and viability.	2
• Emasculation & hybridization in self pollinated species.	1
• Emasculation & hybridization in cross pollinated species.	1
• Different breeding methods-flow chart.	1
• Species and provenance selection techniques.	1
• Recording observation in provenance trial of some important species- recording variation & working out coefficient of variation.	2
• Sampling in seed collection.	1
• Recording stand density in seed stands, seed output; season of seed collection.	2
• Vegetative propagation techniques and tree improvement.	1
• Estimation of phenotypic and genotypic coefficient of variation.	1
• Estimation of genetic advance, heritability and GCA.	1
• Exercise in plus-tree selection.	1
• Seed orchard designs.	1

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TBR-502 WOOD SEASONING AND PRESERVATION Cr. 2(1+1)

Theory

Seasoning of timber – Introduction purpose and scope – Effect of seasoning and preservation of timber on the economy of timber – principles and methods. Influence of temperature – relative humidity and air circulation – Mechanism of wood seasoning – Fibre saturation point and its signification –Determination of moisture content – seasoning of timber – kinds of seasoning – Air seasoning methods, Factors controlling air seasoning – Kiln seasoning – factors controlling kiln seasoning – various kiln drying sheds – classification of timber due to seasoning – seasoning defects – seasoning behaviour for few trees like Teak, Sal, Silver oak, bamboo, Dalbergia Preservation of timber – Introduction – Agencies causing timber deterioration – Decay – Insect – Termites – other external factors – Durability of timbers – classification of timber in the order of durability – mechanism of wood preservation preparation - preparation of wood for preservative treatments – Treatability and Durability of timber. Wood preservation – selection of preservatives - kinds of preservative methods preservation – application processes – pressure and non – pressure process. Fire protection of timbers.

Practical:

Identification of casual agencies of destroying timber – Estimation of defects due to seasoning – measurement of moisture content of wood – study of various seasoning kilns and drying sheds – Visit to wood depot for studying defects- preparation and use of different preservation – Laboratory methods for assessing the effect of preservation study of the preservation application for fresh and dry timber – preservation application for few timber species like Teak, Sal, *Terminalia*, *Dalbergia* etc.

Theory

Content	Lecture
• Seasoning of timber – Introduction purpose and scope – Effect of seasoning and preservation of timber on the economy of timber – principles and methods.	2
• Influence of temperature – relative humidity and air circulation	1
• Mechanism of wood seasoning. Fibre saturation point and its signification	1
• Determination of moisture content	1
• Seasoning of timber – kinds of seasoning – Air seasoning methods, Factors controlling air seasoning	1
• Kiln seasoning – factors controlling kiln seasoning – various kiln drying sheds – classification of timber due to seasoning	1
• Seasoning defects	1
• Seasoning behaviour for few trees like Teak, Sal, Silver oak, bamboo, Dalbergia	2
• Preservation of timber – Introduction – Agencies causing timber	2

- deterioration – Decay – Insect – Termites – other external factors – Durability of timbers
- Classification of timber in the order of durability – mechanism of wood preservation preparation 1
 - Preparation of wood for preservative treatments – Treatability and Durability of timber. 1
 - Wood preservation – selection of preservatives 1
 - Kinds of preservative methods preservation – application processes – pressure and non – pressure process. 1
 - Fire protection of timbers. 1

Practical

Content	Lecture
• Identification of casual agencies of destroying timber	2
• Estimation of defects due to seasoning	1
• Measurement of moisture content of wood	1
• Study of various seasoning kilns and drying sheds	2
• Visit to wood depot for studying defects	1
• Preparation and use of different preservation	2
• Laboratory methods for assessing the effect of preservation study of the preservation application for fresh and dry timber	4
• Preservation application for few timber species like Teak, Sal, <i>Terminalia</i> , <i>Dalbergia</i> etc.	4

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FBL-502 TREE PHYSIOLOGY Cr. 2(1+1)

Theory

Tree structure, growth, development, differentiation and reproduction. Plant growth functions and growth kinetics, Physiological functions and processes in trees. Environmental effects on growth and development. Productivity of tropical deciduous and evergreen forests. Light use efficiency in forest species, canopy structure, plant phyllotaxis and its importance in translocation. Plant light relationship environment. Branching in isolated plants. Monoculture and mixed tree communities. LAI, Photosynthetic efficiency and respiratory losses, sourcesink relationship, Factors affecting photosynthesis. Radiation interception, absorption of water, ascent of sap and water balance. Transport processes with special reference to long distance transport in trees and its impact on plant water relations and photosynthesis. Development of seeds and seedlings. Biocides and growth regulators in forest ecosystems. Senescence and abscission. Role of trees in pollution control.

Practical

Measurement of growth and growth kinetics in seedlings; Measurement of linear growth in tree species; Biometric measurement of plant growth; Estimation of evapotranspiration; Measurement of WUE in trees; Pattern of light interception in different canopy architecture; Measurement of light use efficiency in tree species, using plant efficiency analysis; Growth as influenced by different spectral bands in visible light; Source sink relationship in plants; Translocation studies in plants; Effect of growth promoters on plants; Effect of growth retardants on plants; Use of biocides in tree species; Dormancy and germination studies in tree species; Methods of breaking dormancy in tree species; Studies on senescence in tree species; Regulation of senescence in tree species using agrochemicals; Chemical composition of tree species including shrubs, herbs and wood.

Theory

Content	Lecture
• Tree structure, growth, development, differentiation and reproduction.	1
• Plant growth functions and growth kinetics, Physiological functions and processes in trees.	1
• Environmental effects on growth and development.	1
• Productivity of tropical deciduous and evergreen forests.	1
• Light use efficiency in forest species, canopy structure, plant phyllotaxis and its importance in translocation.	2
• Plant light relationship environment.	1
• Branching in isolated plants.	1
• Monoculture and mixed tree communities.	1
• LAI, Photosynthetic efficiency and respiratory losses, sourcesink relationship,	1
• Factors affecting photosynthesis.	1
• Radiation interception, absorption of water, ascent of sap and water balance.	1
• Transport processes with special reference to long distance transport in trees	1

- and its impact on plant water relations and photosynthesis.
- Development of seeds and seedlings. 1
- Biocides and growth regulators in forest ecosystems. 1
- Senescence and abscission. 1
- Role of trees in pollution control. 1

1

Practical

Content	Lecture
• Measurement of growth and growth kinetics in seedlings;	1
• Measurement of linear growth in tree species;	1
• Biometric measurement of plant growth; Estimation of evapotranspiration;	1
• Measurement of WUE in trees;	1
• Pattern of light interception in different canopy architecture	1
• Measurement of light use efficiency in tree species, using plant efficiency analysis;	2
• Growth as influenced by different spectral bands in visible light;	1
• Source sink relationship in plants; Translocation studies in plants;	1
• Effect of growth promoters on plants	1
• Effect of growth retardants on plants	1
• Use of biocides in tree species;	1
• Dormancy and germination studies in tree species	1
• Methods of breaking dormancy in tree species;	1
• Studies on senescence in tree species;	1
• Regulation of senescence in tree species using agrochemicals;	1
• Chemical composition of tree species including shrubs, herbs and wood.	1

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Theory:

History and importance of forest pathology in India and the world. Relation of plant pathology with forest pathology and other sciences, classification of tree diseases. Role of microbes and fungi in a natural forest ecosystem. Broad classification of different pathogens causing tree diseases. General characteristics of fungi, bacteria, viruses, phytoplasma and phanerogames. Important characters of ascomycetes and basidiomycetes. Important orders and families of Hymenomycetes with a special reference to Aphyllphoraeae and Agaricaceae that contain members causing tree diseases. Growth and reproduction of plant pathogens, infection and factors influencing disease development. Dissemination and survival of plant pathogens. Distribution, economic importance, symptoms, etiology and management of the following. Diseases of important tree species like teak, Dalbergia sp., Acacia spp., neem, cassia, sal, Albizia, Terminalia, mango, jack, pines, deodar, eucalyptus, bamboo, casuarina, rubber, sandal wood, medicinal and aromatic plants grown in different agroforestry systems. Biodegradation of wood in use. Types of wood decay, gross characters of decay, sapstain, different types of rots in hardwoods, softwoods and their prevention. Graveyard test and decay resistant woods. Principles of forest disease management. Definition and scope of disease management in forestry. Importance of disease cycle and economic threshold in disease management. Principles of disease management such as exclusion, cultural, chemical, biological and immunization. Nature of disease resistance. Fungicides and their use in nurseries and plantations. Integration of cultural, chemical, biological and host resistance in disease management, Meristem and tissue culture techniques in disease management. Nursery diseases of important forest species.

Practical:

Study of microscope and micrometry; Collection, observation and preservation of diseased specimens and pathogenic structures; Morphological characters of fungi and bacteria; Morphological characters of viruses and phytoplasma; Preparation of culture media, isolation and subculturing of pathogens; Methods of inoculation and proving pathogenicity (Koch Postulates); Symptoms, signs and diagnosis of tree diseases; Measuring plant disease and methods of loss estimation; Symptoms, etiology and control of diseases/disorders of important tree species (sandal wood, teak and Dalbergia); Symptoms, etiology and control of disease/disorders of (eucalyptus, bamboo, cassia, semul and Terminalia); Symptoms, etiology and control of disease/disorders of important tree species (rubber, casuarina, neem and mango); Symptoms, etiology and control of disease/disorders of important tree species (Albizia, sal, sababul and Acacia); Symptoms, etiology and control of disease/disorders of important tree species (jack, Lagerstroemia, Anogeissus and Emblica); Fungicides, methods of their application and appliances used; Mushroom cultivation; Assessment of seed-microflora of tree species; Use of bio-control agents and mycorrhizae in disease management; Tissue culture techniques in forest pathology; Visit to nurseries and plantation.

Theory

Content	Lecture
• History and importance of forest pathology in India and the world	1
• Relation of plant pathology with forest pathology and other sciences	1
• Classification of tree diseases.	1
• Role of microbes and fungi in a natural forest ecosystem.	1
• Broad classification of different pathogens causing tree diseases.	1
• General characteristics of fungi, bacteria, viruses, phytoplasma and phanerogames.	2
• Important characters of ascomycetes and basidiomycetes.	2
• Important orders and families of Hymenomycetes with a special reference to Aphyllphoraeae and Agaricaceae that contain members causing tree diseases.	2
• Growth and reproduction of plant pathogens, infection and factors influencing disease development.	2
• Dissemination and survival of plant pathogens.	1
• Distribution, economic importance, symptoms, etiology and management of the following.	1
• Diseases of important tree species like teak, <i>Dalbergia sp.</i> , <i>Acacia spp.</i> , <i>neem</i> , <i>cassia</i> , <i>sal</i> , <i>Albizia</i> , <i>Terminalia</i> , mango, jack, pines, <i>deodar</i> , <i>eucalyptus</i> , bamboo, <i>casuarina</i> , rubber, sandal wood,	3
• Medicinal and aromatic plants grown in different agroforestry systems.	2
• Biodegradation of wood in use.	1
• Types of wood decay, gross characters of decay, sapstain, different types of rots in hardwoods, softwoods and their prevention.	2
• Graveyard test and decay resistant woods.	1
• Principles of forest disease management.	1
• Definition and scope of disease management in forestry.	1
• Importance of disease cycle and economic threshold in disease management.	1
• Principles of disease management such as exclusion, cultural, chemical, biological and immunization.	2
• Nature of disease resistance. Fungicides and their use in nurseries and plantations.	1
• Integration of cultural, chemical, biological and host resistance in disease management,	2
• Meristem and tissue culture techniques in disease management.	1
• Nursery diseases of important forest species.	1

Practical

Content	Lecture
• Study of microscope and micrometry	1
• Collection, observation and preservation of diseased specimens and pathogenic structures	1

- Morphological characters of fungi and bacteria 1
- Morphological characters of viruses and phytoplasma 1
- Preparation of culture media, isolation and subculturing of pathogens; 1
- Methods of inoculation and proving pathogenicity (Koch Postulates); Symptoms, signs and diagnosis of tree diseases; 2
- Measuring plant disease and methods of loss estimation; Symptoms, etiology and control of diseases/disorders of important tree species (sandal wood, teak and Dalbergia); 1
- Symptoms, etiology and control of disease/disorders of (eucalyptus, bamboo, cassia, semul and Terminalia); 1
- Symptoms, etiology and control of disease/disorders of important tree species (rubber, casuarina, neem and mango); 1
- Symptoms, etiology and control of disease/disorders of important tree species (Albizia, sal, sababul and Acacia); 1
- Symptoms, etiology and control of disease/disorders of important tree species (jack, Lagerstroemia, Anogeissus and Emblica); 1
- Fungicides, methods of their application and appliances used; 1
- Mushroom cultivation; Assessment of seed-microflora of tree species; 1
- Use of bio-control agents and mycorrhizae in disease management; 1
- Tissue culture techniques in forest pathology; Visit to nurseries and plantation. 2

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8. Speight, M.S. and D. Wainhouse. 1989. Ecology and Management of Forest Insects. Clarendon Press, Oxford.

Theory:

Nature and scope of marketing. Approaches to marketing and the study of marketing functions with special reference to forestry. Classification of market, market structure and conduct of important timber and non-timber markets. Marketing channels, costs, margins and price spread – concepts and applications. Concepts of market integration and marketing efficiency. Role of public and private agencies in marketing of forest produce. Market inefficiencies in the trade of forest produce and measures to check the same. Fundamentals of international trade. Domestic and international trade in timber and non-timber forestry outputs. Demand forecasts – concept and methods. WTO – background, structure, functions and decision making process. IPRs and their implications for forestry and allied sectors in the country.

Practical:

Introduction about wood trade, safety rules, shop floor, first aid wood working processes – measuring, making, sawing, planing, chiseling, drilling, boring, grooving and rebating classification, identification of wood working tools. Sawing practice types – ripping cross cutting, cutting, oblique sawing etc. Use of saw horse bench, hook bench, stopete. Identification of timber, shoeing defects. Use of planes, setting on planes – holding, planning technique – making gauge, test of accuracy, flatness, twistness of surface – use of straight edge – bench stop try square – winding strips – sharpening of edge flats. Joint practices – making, framing joints, halving joints – trenching and housing joints – Mortise and Kenon joints, plains, haunched –stop stennon – force face tenon, bridle jointss. Dovetail joints – types. Different types of broadening joints – simple butt, related butt, pocket, pocket crew, glued butt, tongue and groove butt joints. Lengthening joints – types – scrap joints scrap table scrap, tension scrap. Demonstration and use of special planes – compass planes, mounding planes. Practice making a small wall bracket, chalk box, tea hinges hasp – staple tower bolt – types. Use of hand drill, country drill, vatchet brace, and drill, drill bits, Lay out of different furniture. Nails – screws – lock hinges hasp – staple tower, bolt – types. Carving ornamental works – tools used – demonstration making small box with Sunmica top – carving exercise. Wood preservation techniques – application and testing

Theory

	Content	Lecture
•	Nature and scope of marketing.	1
•	Approaches to marketing and the study of marketing functions with special reference to forestry.	2
•	Classification of market, market structure and conduct of important timber and non-timber markets.	2
•	Marketing channels, costs, margins and price spread – concepts and applications.	2
•	Concepts of market integration and marketing efficiency.	1
•	Role of public and private agencies in marketing of forest produce.	2

- Market inefficiencies in the trade of forest produce and measures to check the same. 1
- Fundamentals of international trade. 2
- Domestic and international trade in timber and non-timber forestry outputs. 1
- Demand forecasts – concept and methods. 1
- WTO – background, structure, functions and decision making process. 1
- IPRs and their implications for forestry and allied sectors in the country. 1

Practical

Content	Lecture
• Introduction about wood trade, safety rules, shop floor, first aid wood working processes – measuring, making, sawing, planing, chiseling, drilling, boring, grooving and rebating classification, identification of wood working tools.	2
• Sawing practice types – ripping cross cutting, cutting, oblique sawing etc.	1
• Use of saw horse bench, hook bench, stopete. Identification of timber, shoeing defects.	1
• Use of planes, setting on planes – holding, planning technique – making gauge, test of accuracy, flatness, twistness of surface – use of straight edge – bench stop try square – winding strips – sharpening of edge flats.	2
• Joint practices – making, framing joints, halving joints – trenching and housing joints – Mortise and Kenon joints, plains, haunched –stop stenon – force face tenon, bridle joints.	2
• Dovetail joints – types. Different types of broadening joints – simple butt, related butt, pocket, pocket crew, glued butt, tongue and groove butt joints.	2
• Lengthening joints – types – scrap joints scrap table scrap, tension scrap.	1
• Demonstration and use of special planes – compass planes, mounding planes. Practice making a small wall bracket, chalk box, tea hinges hasp – staple tower bolt – types.	1
• Use of hand drill, country drill, vatchet brace, and drill, drill bits, Lay out of different furniture.	2
• Nails – screws – lock hinges hasp – staple tower, bolt – types.	1
• Carving ornamental works – tools used – demonstration making small box with Sunmica top – carving exercise.	1
• Wood preservation techniques – application and testing	1

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1. Anonymous. 1961. Wealth of India - Raw Materials. C.S.I.R., New Delhi.
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SVC-501 LOGGING & ERGONOMICS Cr. 2(1+1)

Theory:

Definition and scope of logging, logging plan and execution. Location and demarcation of the area for logging and estimation of produce available for extraction. Implements used in logging operation- traditional and improved tools. Felling rules and methods. Conversion, measurement and description of converted material. Means of transport of timber- carts, dragging, skidding, overhead transport, ropeways, skylines. Transport by road and railways. Transport by water- floating, rafting and concept of booms. Grading and Storage of timber in the depots for display and disposal, temporary and final storage. Timber Depots- types, lay out and management. Systems of disposal of timber. Size of material in logging operation. Ergonomics: definition, components and provision of energy. Requirement of energy and rest periods. Effect of heavy work, posture, weather and nutrition. Personal protective equipments, safety helmets, ear and eye protections. Accidents: causes, statistics, safety rules and first aids. Plants, animals and insect infestations; diseases and their prevention.

Practical:

Survey and demarcation of area intended for logging and listing of permanent boundary marks; Marking of trees for logging operation and preparation of marking list; Information procedure regarding handing and taking over before starting actual logging operation. Contract letters and other formalities to be completed; Equipments and tools used in logging operations and their uses; Planning and execution of different logging operation in a phase wise manner; Application of felling rules in the forests for felling of standing trees at different localities; Instructions regarding maintenance of various records and registers in logging operations; Conversion of felled trees into logs, poles, firewood, pulpwood etc.; Measurement of logs, poles and firewood in forests and maintenance of records in relevant registers; Minor and other types of transport practicable at felling sites; Final transport, information regarding transit permits for various types of forest produce; Visit to local dumping yard (timber depot) to trace the logs delivered from different forest sites; Sorting of logs, poles and firewood in the depots according to species, quality, length and girth classes; Stacking and stock checking of different logs, poles and firewood in the depots so as to confirm that all the converted materials in the forests have reached their destination; Lotting of the stacks for display and final disposal; Recording of the lots for auction sale. Final disposal of the material; Visit during the auction sale in the government timber depots; Preparation of ergonomic check lists.

Theory

Content	Lecture
• Definition and scope of logging, logging plan and execution.	1
• Location and demarcation of the area for logging and estimation of produce available for extraction.	1
• Implements used in logging operation- traditional and improved tools.	1
• Felling rules and methods.	1
• Conversion, measurement and description of converted material.	1
• Means of transport of timber- carts, dragging, skidding, overhead transport,	1

- ropeways, skylines.
- Transport by road and railways. Transport by water- floating, rafting and concept of booms. 1
- Grading and Storage of timber in the depots for display and disposal, temporary and final storage. 1
- Timber Depots- types, lay out and management. 1
- Systems of disposal of timber. 1
- Size of material in logging operation. 1
- Ergonomics: definition, components and provision of energy. 1
- Requirement of energy and rest periods. 1
- Effect of heavy work, posture, weather and nutrition. 1
- Personal protective equipments, safety helmets, ear and eye protections. 1
- Accidents: causes, statistics, safety rules and first aids. 1
- Plants, animals and insect infestations; diseases and their prevention. 1

Practical

Content	Lecture
• Survey and demarcation of area intended for logging and listing of permanent boundary marks;	1
• Marking of trees for logging operation and preparation of marking list;	1
• Information procedure regarding handing and taking over before starting actual logging operation.	1
• Contract letters and other formalities to be completed;	1
• Equipments and tools used in logging operations and their uses;	1
• Planning and execution of different logging operation in a phase wise manner;	1
• Application of felling rules in the forests for felling of standing trees at different localities;	1
• Instructions regarding maintenance of various records and registers in logging operations; Conversion of felled trees into logs, poles, firewood, pulpwood etc.;	1
• Measurement of logs, poles and firewood in forests and maintenance of records in relevant registers;	1
• Minor and other types of transport practicable at felling sites;	1
• Final transport, information regarding transit permits for various types of forest produce;	1
• Visit to local dumping yard (timber depot) to trace the logs delivered from different forest sites;	1
• Sorting of logs, poles and firewood in the depots according to species, quality, length and girth classes;	1
• Stacking and stock checking of different logs, poles and firewood in the depots so as to confirm that all the converted materials in the forests have reached their destination;	1
• Lotting of the stacks for display and final disposal;	1
• Recording of the lots for auction sale. Final disposal of the material;	1

- Visit during the auction sale in the government timber depots; Preparation of ergonomic check lists.

1

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SEMESTER – VI

AGF-502 FOREST UTILIZATION – II (Non Timber Forest Products) Cr. 3(2+1)

Theory:

Introduction, methods of collection, management and importance of Non-Timber Forest Products (NTFP). Fodder (grasses and tree leaves), canes and bamboos. Essential Oils - methods of extraction, classification, storage and uses. Non-essential oils – nature, occurrence, methods of extraction, classification and uses. Important fixed oil yielding trees. Gums and resins –definition, classification, sources, collection and uses. Factors affecting gum formation. Important gum yielding plants. Resins and Oleoresins, their formation in plants and classification of resins. Tans- nature, classification, uses and important tannin yielding plants. Dyes – classification and sources of dyes. Beedi leaves – sources, collection and processing. Fibers and flosses. Katha and Cutch – sources, extraction and uses. Drugs, wild fruits, spices, poisons and bio-pesticides.

Practical:

Visit to nearby forests to study important NTFP yielding plants. Study of fodder: grasses and tree leaves. Study of canes and bamboos and their sources. Study of essential oils and their sources. Study of non-essential oils and their sources. Study of gums and resins and their collection. Study of tans and dyes and their sources. Study of fibers, flosses and their collection from nearby forests. Visit to Herbal Gardens and herbaria to study medicinal plants. Study of plants yielding drugs, spices, wild fruits, poisons and bio-pesticides and their collection from nearby forests. Visit to nearby extraction units.

Theory

Content	Lecture
• Introduction, methods of collection, management and importance of Non-Timber Forest Products (NTFP).	4
• Fodder (grasses and tree leaves), canes and bamboos.	3
• Essential Oils - methods of extraction, classification, storage and uses.	3
• Non-essential oils – nature, occurrence, methods of extraction, classification and uses. Important fixed oil yielding trees.	4
• Gums and resins –definition, classification, sources, collection and uses.	3
• Factors affecting gum formation.	2
• Important gum yielding plants.	1
• Resins and Oleoresins, their formation in plants and classification of resins.	2
• Tans- nature, classification, uses and important tannin yielding plants.	2
• Dyes – classification and sources of dyes.	2
• Beedi leaves – sources, collection and processing.	2
• Fibers and flosses.	2
• Katha and Cutch – sources, extraction and uses.	2
• Drugs, wild fruits, spices, poisons and bio-pesticides.	2

Practical

Content	Lecture
• Visit to nearby forests to study important NTFP yielding plants.	2
• Study of fodder: grasses and tree leaves.	2
• Study of canes and bamboos and their sources.	2
• Study of essential oils and their sources.	1
• Study of non-essential oils and their sources.	1
• Study of gums and resins and their collection.	2
• Study of tans and dyes and their sources.	1
• Study of fibers, flosses and their collection from nearby forests.	2
• Visit to Herbal Gardens and herbaria to study medicinal plants.	1
• Study of plants yielding drugs, spices, wild fruits, poisons and bio-pesticides and their collection from nearby forests.	2
• Visit to nearby extraction units.	1

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Theory:

Forest Policy: definition, necessity and scope. Legal and institutional approaches to forest resource management. Objectives of forest policy- necessity and scope- range and various considerations – foundation of stable forest policy - History of Forest Policy in India - Forest policy of 1894 – the need for revision – National Forest Policy of 1952 – recommendations of National Commission on Agriculture 1976 – National Forest Policy 1988. Forest protection and law- study of law in relation to forest education – necessity of forest law – the concepts of rights, obligations and privileges – their relevance to forestry - Indian Forest Act of 1927 – Forest Conservation Act of 1980 – its amendment in 1988 – wildlife protection Act of 1972 – Uttar Pradesh Forest Acts – International Timber Trade Agreement _ GATT Agreements its relevance to timber exports- Rio submit its relevance to timber trade.

Theory

Content	Lecture
• Forest Policy: definition, necessity and scope.	1
• Legal and institutional approaches to forest resource management.	1
• Objectives of forest policy- necessity and scope- range and various considerations – foundation of stable forest policy .	2
• History of Forest Policy in India - Forest policy of 1894 .	1
• The need for revision – National Forest Policy of 1952.	1
• Recommendations of National Commission on Agriculture 1976.	1
• National Forest Policy 1988.	1
• Forest protection and law- study of law in relation to forest education	1
• Necessity of forest law – the concepts of rights, obligations and privileges – their relevance to forestry	2
• Indian Forest Act of 1927	1
• Forest Conservation Act of 1980 – its amendment in 1988	1
• Wildlife protection Act of 1972	1
• Uttar Pradesh Forest Acts – International Timber Trade Agreement.	1
• GATT Agreements its relevance to timber exports.	1
• Rio submit its relevance to timber trade.	1

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SVC-503 PLANTATION FORESTRY Cr. 2(1+1)

Theory:

Definition, scope and impediments. Plantation forests - planting plan, plantation records, maps. Plantation establishment -legal title of land, survey, site selection. Site preparation - purpose and methods. Planting - layout, time of planting, planting pattern, spacing, gap filling, planting methods, direct seedling. Choice of species on ecological aspects - afforestation of dry land, wet land, other adverse sites and taungya. Enrichment planting, nurse and cover crops. Intercultural operations. Plantation maintenance - weed control, climber cutting, staking, singling and pruning. Thinning - definition, objectives. Effects of thinning - physiological and mensurational. Effect of methods of thinning on stand development. Energy and industrial plantation - definition, scope, species, establishment, management and impact on environment. Plantation economics.

Practical:

Study of tools, materials and operations for establishment of plantations. Site selection and site preparation. Exercises on planting and tending. Study of the special techniques for difficult sites. Exercises on protection of plantations. Exercise on plantation layout. Collection of data for survival and growth performance. Use of fertilizers, weedicides for plantation management.

Theory

Content	Lecture
• Definition, scope and impediments.	1
• Plantation forests - planting plan, plantation records, maps.	1
• Plantation establishment -legal title of land, survey, site selection.	1
• Site preparation - purpose and methods.	1
• Planting - layout, time of planting, planting pattern, spacing, gap filling, planting methods, direct seedling.	2
• Choice of species on ecological aspects - afforestation of dry land, wet land, other adverse sites and taungya.	2
• Enrichment planting, nurse and cover crops.	1
• Intercultural operations. Plantation maintenance - weed control, climber cutting, staking, singling and pruning.	2
• Thinning - definition, objectives. Effects of thinning - physiological and mensurational.	2
• Effect of methods of thinning on stand development.	1
• Energy and industrial plantation - definition, scope, species, establishment, management and impact on environment.	2
• Plantation economics.	1

Practical

Content	Lecture
• Study of tools, materials and operations for establishment of plantations.	2
• Site selection and site preparation.	2
• Exercises on planting and tending.	2
• Study of the special techniques for difficult sites.	2

- Exercises on protection of plantations. 2
- Exercise on plantation layout. 2
- Collection of data for survival and growth performance. 2
- Use of fertilizers, weedicides for plantation management. 3

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TBR-503 FOREST BIOTECHNOLOGY Cr. 3(2+1)

Theory:

Historical developments in bio-technology. Application of plant tissue culture in plant improvement Micropropagation: Principles and application in forestry trees and medicinal plants; meristem culture; plant cell and suspension cultures; organogenesis and regeneration in vitro and somaclonal variations; genetic engineering techniques; transgenic plants with case studies of tree species to diseases, germplasm conservation; Plant growth hormones and environmental factors for plant tissue culture. Totipotency of cells. Embryogenesis, organogenesis and asomaclones. Shoot tip culture and clonal propagation. Meristem culture and disease elimination. Anther, pollen and microspore culture, ovary and embryo culture, haploid, somatic hybrids – cybrids – transformed plants. Tissue culture for tree improvement. Micropropagation. Marker Aided selection – isozymes –RFLP, RAPD, PCR. Application in Forestry. Biotechnology of tree improvement for rapid propagation and Biomass energy production. Micrografting and its application to tree improvement. Genetic code. Methods of gene transferees – direct and indirect genetic engineering – gene cloning and recombinant technology. Vectors for genetic engineering Application of genetic engineering in medical, industrial, agricultural, Forestry animals and environmental sciences.

Practical:

Equipments used in tissue culture techniques. Sketches utilities. Preparation of stock solutions. Preparation of culture medium. Exercises on micro propagation of important tree species, Establishment of callus in few tree species . Raising aseptic seeding of tree species, under aseptic condition. Induction of organogenesis Rescue and culture of embryos. Anther culture of tree species. Meristem culturing. Visit to Biotechnology Laboratory . Rooting, Hardening and planting out to tissue culture palnts. Exercises on In-vitro pollination. Sterilization techniques; preparation of culture medium for establishment of explants of forestry plants, multiplication of shoots, induction of roots; meristem culturing; callus cultures

Theory

Content	Lecture
• Historical developments in bio-technology.	1
• Application of plant tissue culture in plant improvement.	1
• Micropropagation-Principles and application in forestry trees and medicinal plants	1
• Meristem culture; plant cell and suspension cultures;	1
• Organogenesis and regeneration in vitro and somaclonal variations	1
• Genetic engineering techniques;	1
• Transgenic plants with case studies of tree species to diseases,	1
• Germplasm conservation;	1
• Plant growth hormones and environmental factors for plant tissue culture.	1
• Totipotency of cells.	1
• Embryogenesis, organogenesis and asomaclones.	2
• Shoot tip culture and clonal propagation.	1
• Meristem culture and disease elimination.	1

• Anther, pollen and microspore culture, ovary and embryo culture, haploid, somatic hybrids	3
• cybrids – transformed plants.	1
• Tissue culture for tree improvement.	1
• Micropropagation.	1
• Marker Aided selection	1
• isozymes –RFLP, RAPD, PCR and its application in Forestry.	3
• Biotechnology of tree improvement for rapid propagation and Biomass energy production.	2
• Micrografting and its application to tree improvement.	1
• Genetic code.	1
• Methods of gene transferencees – direct and indirect genetic engineering	1
• Gene cloning and recombinant technology.	1
• Vectors for genetic engineering	1
• Application of genetic engineering in medical, industrial,	1
• Application of genetic engineering in agricultural, Forestry animals and environmental sciences.	2

Practical

Content	Lecture
• Equipments used in tissue culture techniques.	1
• Preparation of stock solutions.	2
• Preparation of culture medium.	1
• Exercises on micro propagation of important tree species	1
• Establishment of callus in few tree species .	1
• Raising aseptic seeding of tree species, under aseptic condition.	1
• Induction of organogenesis Rescue and culture of embryos.	1
• Anther culture of tree species.	1
• Meristem culturing.	1
• Visit to Biotechnology Laboratory .	1
• Rooting, Hardening and planting out to tissue culture plants.	1
• Exercises on In-vitro pollination.	1
• Sterilization techniques; preparation of culture medium for establishment of explants of forestry plants,	2
• Multiplication of shoots and induction of roots;	1
• Meristem culturing; callus cultures	1

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ECON-508 FOREST PRODUCTION ECONOMICS AND MARKETING

Cr. 3(2+1)

Theory:

Concepts and scope of forest economics – importance of forest and wildlife in economic development – production relationship – factor product relationship – product function – Law of diminishing marginal return – impact of technological changes in production. Cost concept – cost function – cost curves – factor relationship – isoquants – isocost line – least cost combination – expansion path – redge line – optimum level of output – product relationship – production possibility curve – isprevenue line – principle of comparative advantage – equimarginal return – time comparison principle – breakeven analysis. Characteristics of depreciation – methods of estimation – opportunity cost principle – budgeting techniques – partial and complete budgeting – Linear programming – risk and uncertainty – selection of enterprises. Nature and scope of marketing. Approaches to marketing and the study of marketing functions with special reference to forestry. Classification of market, market structure and conduct of important timber and non-timber markets – channels of forest produce – price spread – agencies involved in marketing of wood and non wood forest produce – methods of selling forest produce – International Tropical Timber Organization – members – functions.

Practical:

Exercises in solving problems on production principles. Cost of cultivation of trees – break even analysis and budgeting. Studying government, co-operative and private agencies involved in marketing of wood and non wood forest produce – working out price spread. Library review of studies on marketing, visits to local timber and non-timber markets; collection and analysis of price and quantity data for various forest products; study of marketing channels and price spread for important timber and non-timber forestry products.

Theory

Content	Lecture
• Concepts and scope of forest economics – importance of forest and wildlife in economic development	2
• Production relationship – factor product relationship – product function	2
• Low of diminishing marginal return – impact of technological changes in production.	2
• Cost concept – cost function – cost curves – factor relationship – isoquants – isocost line	2
• Least cost combination – expansion path – redge line – optimum level of output	3
• Product relationship – production possibility curve – isprevenue line	2
• Principle of comparative advantage – equimarginal return – time comparison principle breakeven analysis.	2
• Characteristics of depreciation – methods of estimation – opportunity cost	3

principle	
• Budgeting techniques – partial and complete budgeting	2
• Linear programming – risk and uncertainty – selection of enterprises.	2
• Nature and scope of marketing.	1
• Approaches to marketing and the study of marketing functions with special reference to forestry.	2
• Classification of market, market structure and conduct of important timber and non-timber markets	2
• Channels of forest produce – price spread	1
• Agencies involved in marketing of wood and non wood forest produce	2
• Methods of selling forest produce	1
• International Tropical Timber Organization – members – functions.	2

Practical

Content	Lecture
• Exercises in solving problems on production principles.	1
• Cost of cultivation of trees – break even analysis and budgeting.	1
• Studying government, co-operative and private agencies involved in marketing of wood and non wood forest produce	3
• Working out price spread.	2
• Library review of studies on marketing.	2
• Visits to local timber and non-timber markets	2
• Collection and analysis of price and quantity data for various forest products	3
• Study of marketing channels and price spread for important timber and non-timber forestry products.	3

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SAC-610 FOREST SOILS AND WATERSHED MANAGEMENT Cr. 3(2+1)

Theory:

Introduction – Need for Soil Conservation and Watershed Management – Hydrologic Cycle – Importance – Rainfall, Intensity, Duration and frequency – Infiltration, percolation, evaporation, transpiration – Salutation to dams – streams ganging. Soil conservation through forests and forest plantations – Historical review problems –soil erosion – Principles – geological and accelerated – water – kinds and forms – causes and effects- degree of erosion – Wind erosion – salutation –surface creep – sand dune stabilization – shelter belts and wind breaks. Land capability classification - Determination – Recommended land use soil conservation practices – Runoff – Runoff process – Factors affecting – prediction and Estimation of runoff. Engineering Measures for erosion control – contour – Graded bundling, Bench, Terracing , Stone walls – Design – Structures for soil conservation – Agronomic measures – Land use and conservation agronomy – Grassland management – Agroforestry _ Horticultural – Erosion control measures for non – Agricultural lands – Soil conservation on Wastelands – contour and staggered trenching – Gully control structures – Temporary – permanent – Retaining walls – Gully and Ravine Reclamation. Watershed Management –Definition – Size Characteristics – Planning and implementation – selection of Priority areas – watershed work plan. Water Harvesting Techniques – Waster conservation methods – Treatment of catchments – storage structures – Water Harvesting for Trees and shrubs.

Practical:

Hydrologic cycle diagrams –rainfall computation – intensity curve – infiltration in various forest soils – sediment monitoring in streams - estimation procedure – wind erosion specialized water – contour bound – graded bund – contour stone wall – gully, check dam and percolation pond – watershed – microcatchment – preparation of watershed development and management plants.

Theory

Content	Lecture
• Introduction – Need for Soil Conservation and Watershed Management – Hydrologic Cycle – Importance	2
• Rainfall, Intensity, Duration and frequency – Infiltration, percolation, evaporation, transpiration – Salutation to dams – streams ganging.	3
• Soil conservation through forests and forest plantations – Historical review problems –soil erosion	2
• Principles – geological and accelerated – water – kinds and forms – causes and effects- degree of erosion	2
• Wind erosion – salutation –surface creep – sand dune stabilization – shelter belts and wind breaks.	3
• Land capability classification - Determination – Recommended land use soil conservation practices	2
• Runoff – Runoff process – Factors affecting – prediction and Estimation of	3

runoff.

- Engineering Measures for erosion control – contour – Graded bundling, Bench, Terracing , Stone walls – Design 3
- Structures for soil conservation – Agronomic measures – Land use and conservation agronomy – Grassland management 2
- Agroforestry _ Horticultural – Erosion control measures for non – Agricultural lands – 2
- Soil conservation on Wastelands – contour and staggered trenching – Gully control structures 3
- Temporary – permanent – Retaining walls – Gully and Ravine Reclamation. 2
- Watershed Management –Definition – Size Characteristics – Planning and implementation – selection of Priority areas – watershed work plan. 3
- Water Harvesting Techniques – Waster conservation methods – Treatment of catchments – storage structures – Water Harvesting for Trees and shrubs. 3

Practical

Content	Lecture
• Hydrologic cycle diagrams –rainfall computation	2
• Intensity curve – infiltration in various forest soils	3
• Sediment monitoring in streams - estimation procedure	2
• Wind erosion specialized water – contour bound	4
• Graded bund – contour stone wall	3
• Gully, check dam and percolation pond – watershed	3
• Micro-catchment – preparation of watershed development and management plants.	3

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HORT-403 FRUIT PRODUCTION AND PLANTATION CROPS Cr. 3(2+1)

Theory:

Fruit Production: Main growing regions of fruits like Mango, Banana, Guava, Papaya, Ber, Datepalm, Litchi, Apple, Pear, Peach, Plum, Apricot, Almond, Walnut, Cherry etc. - Classification of these fruits and nomenclature, their climatic and cultural requirement, cultivars, nutrition, irrigation, pruning & training requirements. Their special problems, techniques involved in better production & quality

Plantation Crops : Origin, distribution and morphology of plantation crops – tea, coffee, coconut, arecanut and rubber – Introduction methods including plant protection chemicals, methods and problems of processing and economic utilization.

Practical:

Fruit Production : Identification and description of cultivars, cultural practices techniques for quality improvement and class tour to various fruit growing zones.

Plantation Crops : Morphological study – Planting methods – All cultural methods – Harvesting & Processing – Post harvest technology of various products – By-products recycling with emphasis on sustainable agriculture.

Theory

Content	Lecture
• Fruit Production: Main growing regions of fruits like Mango, Banana, Guava,	3
• Main growing regions of fruits like Papaya, Ber, Datepalm, Litchi,	3
• Main growing regions of fruits like Apple, Pear, Peach, Plum,	3
• Main growing regions of fruits like Apricot, Almond, Walnut, Cherry etc.	3
• Classification of these fruits and nomenclature	2
• Climatic and cultural requirement, cultivars, nutrition	2
• Irrigation, pruning & training requirements.	3
• Their special problems, techniques involved in better production & quality	3
• Plantation Crops: Origin, distribution and morphology of plantation crops – tea, coffee, coconut,	3
• Origin, distribution and morphology of plantation crops - arecanut and rubber	3
• Introduction methods including plant protection chemicals	3
• Methods and problems of processing and economic utilization	3

Practical

Content	Lecture
• Fruit Production : Identification and description of cultivars, cultural practices techniques for quality improvement and class tour to various fruit	3

growing zones.	
• Plantation Crops: Morphological study	2
• Planting methods	3
• All cultural methods	3
• Harvesting & Processing	2
• Post harvest technology of various products	2
• By-products recycling with emphasis on sustainable agriculture.	2

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Theory

Introduction and definition. Relationship with other disciplines. History and development. Types and distribution around world. Grasses : characters and classification. Characteristics of rangelands: components of vegetation, nutrient value of forages and environmental factors. Importance of rangelands. Indian rangelands : origin, distribution, characteristics, status and management. Ecology in relation to grazing – Ecological concepts relevant in rangeland management, animal – plant interactions, effect on vegetation and plant succession. Plant morphology and physiology in relation to grazing factors – factors influencing food synthesis and reproduction. Range inventory – mapping, methods of sampling and evaluation, purposes and principles, Carrying capacity. Range utilization. Intensity and frequency of use. Range management – topography, animal species, forage preference, density. Grazing – grazing intensity, season of grazing, types – their merits and demerits. Animal unit (A.U.). Fire – controlled burning, effect of fire on vegetation and fauna. Weed control – types, their characteristics, chemical and biological control. Range improvement – range seeding, introduction of grasses and legumes, fertilization, soil and water conservation strategies. Multiple use.

Practical:

Identification of grasses, forbs and legumes and fodder trees; Rangeland inventory – ground cover, plant height, relative dominance, etc.; Assessing nutrient; Estimating range condition from plant composition; Determine range utilization, carrying capacity of rangelands; Indicators of heavy grazing; Studying plant preference by grazing animals; Grazing systems: simulations, indicators of heavy grazing.

Theory

Content	Lecture
• Introduction and definition.	1
• Relationship with other disciplines.	1
• History and development.	1
• Types and distribution around world.	1
• Grasses: characters and classification.	1
• Characteristics of rangelands: components of vegetation, nutrient value of forages and environmental factors.	2
• Importance of rangelands.	1
• Indian rangelands: origin, distribution, characteristics, status and management.	2
• Ecology in relation to grazing – Ecological concepts relevant in rangeland management, animal.	2
• Plant interactions, effect on vegetation and plant succession.	2
• Plant morphology and physiology in relation to grazing factors	1
• Factors influencing food synthesis and reproduction.	1
• Range inventory – mapping, methods of sampling and evaluation, purposes	2

- and principles
- Carrying capacity. Range utilization. 1
- Intensity and frequency of use. 1
- Range management – topography, animal species, forage preference, density. 3
- Grazing – grazing intensity, season of grazing, types – their merits and demerits. 3
- Animal unit (A.U.). Fire – controlled burning, effect of fire on vegetation and fauna. 3
- Weed control – types, their characteristics, chemical and biological control. 2
- Range improvement – range seeding, introduction of grasses and legumes, fertilization, soil and water conservation strategies. Multiple use. 3

Practical

Content	Lecture
• Identification of grasses, forbs and legumes and fodder trees	2
• Rangeland inventory – ground cover, plant height, relative dominance, etc.	3
• Assessing nutrient; Estimating range condition from plant composition	2
• Determine range utilization, carrying capacity of rangelands	3
• Indicators of heavy grazing	2
• Studying plant preference by grazing animals	2
• Grazing systems: simulations	3
• Indicators of heavy grazing.	2

References

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2. Simmonds, W.W. 1986. A short review of farming systems research in the tropics. Expl. Agric. 22:1-13.
3. Francies, C.A. (1986). Multiple Cropping System Mac. Millan – New York.
4. Hidebrand. P.E.X. and F. Poey (1985). Onfarm agronomic trials in farming systems research and extension. Tynne Piennner Publishers. Boulder – Colombo.
5. Jeswani,L.M. and Baldev,B.(1990). Advances in Pulse Production technology. ICAR, New Delhi.
6. Malsen,L.J.G.V. and S.Somaatmadja,(1993). PROSEA - Plant Resources of South East Asia. No.1. Pulses. International Book Distributors, Dehradun.
7. Zandstra, H. E.Price, J. Lisinger and R.S. Morris, 1981. Methodology for on-farm cropping systems. Research, IRRI. Los Banos – Philippines.
8. Palaniappan. SP (1985). Cropping Systems in the Tropics – Principles and management. Willey Eastersn Limited. New Delhi.
9. Ruthenberg. H. (1980). Farming Systems in the tropics. Oxford Clarendon Press.

SEMESTER – VII

“EXPERIENTIAL LEARNING FOR HANDS ON TRAINING IN FORESTRY”

Five Supplementary Subjects (**any on Optional**)

S.No.	Course Code	Subject	Credit
1	SES 600	Water Management	20 (0+20)
2	ENV 600	Climate Change	20 (0+20)
2	ENV 620	Bio-Energy	20 (0+20)
4	AGF 600	Eco-Tourism	20 (0+20)
5	ENV 630	Environmental Impact Assessment	20 (0+20)

Each subject will have 7 to 10 Experimental Learning/Training courses which should be conducted in single semester (preferably in 7th Semester).

1. SES-600 WATER MANAGEMENT Cr. 20(0+20)

Activity	Credit
<ul style="list-style-type: none">Water Resources in India in relation to irrigation management. Roles of water and methods of moisture stress detection in crop plant. Augmentation and development of water resources.	0+2
<ul style="list-style-type: none">Determination of soil mechanical composition, bulk density, aggregate stability, water holding capacity and infiltration rate.	0+3
<ul style="list-style-type: none">Estimation of peak run off rates, water conveyance efficiency, measurement of water in open channel and pipes.	0+2
<ul style="list-style-type: none">Methods of soil moisture estimation. Methods of water harvesting and in-situ moisture conservation. Determination of soil thermal regimes.	0+2
<ul style="list-style-type: none">Mechanical and vegetative measures for catchment areas.	0+2
<ul style="list-style-type: none">Design of earthen dams, construction of farm ponds (LDPE lined Pucca tanks) estimation of capacity of farm ponds.	0+2
<ul style="list-style-type: none">Estimation of water requirement, Irrigation methods viz., basin, furrow, border, drip & sprinkler irrigation. Performance evaluation of different irrigation methods.	0+3
<ul style="list-style-type: none">Surface and sub-surface drainage systems.	0+1
<ul style="list-style-type: none">Remote sensing and GIS in water resources management.	0+2
<ul style="list-style-type: none">Project Report and Presentation.	0+1
Total	0+20

2. ENV-600 CLIMATE CHANGE

Cr. 20(0+20)

Activity	Credit
<ul style="list-style-type: none"> To analyze the past and present trends of climatic parameters viz., temperature, rainfall, snowfall, chilling hours, fog, wind, smog, cold wave and cloud burst, etc. 	0+2
<ul style="list-style-type: none"> To analyze the impact of climate change on productivity /yield levels of forest, agriculture, horticulture and water resources, etc. 	0+2
<ul style="list-style-type: none"> Study climate change mitigation (carbon sequestration) potential of different land use systems viz., forests, agroforestry and plantations of fast growing tree species, fruits, etc. 	0+2
<ul style="list-style-type: none"> Study the impact of climate change on disease and insect-pest infestation on forest, fruit trees and agricultural crops. 	0+1
<ul style="list-style-type: none"> Assess the impact of extreme wheatear conditions viz., cold wave, floods, drought, cloud burst on land, water, crops, trees, animals, etc. 	0+2
<ul style="list-style-type: none"> Document the current knowledge base on impact, adaptation and vulnerability of agriculture, horticulture, forestry and resources to climate change. 	0+2
<ul style="list-style-type: none"> Study the socio-economic impact of climate change under different agro climatic zones. 	0+2
<ul style="list-style-type: none"> Study the impact of climate change on ecotourism, natural regeneration of important trees, plant biodiversity, wildlife, fisheries and forest fires. 	0+3
<ul style="list-style-type: none"> Develop prediction models for forecasting impacts of whether trends on productivity, climate type, water resources and land use pattern 	0+2
<ul style="list-style-type: none"> Project Report and Presentation. 	0+2
Total	0+20

3. ENV-620 BIO-ENERGY

Cr. 20(0+20)

Activity	Credit
Project Development: Defining objectives, methodology to be adopted, advisement needed and necessary support in the field of solar and bio energy.	0+1
1 Solar energy based technologies.	
Survey and data collection: Measurement of solar radiation and related data of different climatic zone in the state.	0+1
Application: The activity includes the use of solar cooker, solar water heating system, solar passive house technology (sum space, thermal wall, insulation and other solar passive features for room heating and monitoring), solar water pump for irrigation, solar still for preparation of potable water and solar photovoltaic panel for production and storage of electricity for lighting.	0+5
Income Generation: Application of solar drier for the drying of horticulture and forestry crops, use of solar greenhouse for nursery raising, production of off season vegetables and floriculture	0+2
2 Bio-energy based technologies	
Survey and data collection: Identification of bio wastes sources of the state for the production of bio-fuels.	0+1
Application: The activity includes the use of forest and agro wastes for the preparation of briquettes as a fuel, smoke emission analysis of cooking devices, estimation of caloric, value of different fuels, biogas plant (Production of gas) for cooking and lighting, improved cookstoves (construction and thermal efficiency test), metal cookstove for room heating (thermal efficiency test), gasifier (identification and use of forest species for the production of gas) for power generation and its subsequent applications for income generation.	0+7
Field Visit to different industries and institutions involved in renewable energy technologies	0+2
Project report and Presentation.	0+2
Total	0+20

4. AGF-600 ECO TOURISM Cr. 20(0+20)

Activity	Credit
<ul style="list-style-type: none"> • Visits to different ecotourism sites and identification of inherited tourism components. Identification of the local sociological implications. Exercises on blending of local identified forms of ecotourism. 	0+2
<ul style="list-style-type: none"> • Preparation planning and designing of recreation parks, thematic parks, topiary practices, arboriculture and preparation of planting patterns. 	0+2
<ul style="list-style-type: none"> • Preparation of ecotourism activity maps. Preparation pf route maps to important national parks and sanctuaries. Preparation of information brochures. 	0+3
<ul style="list-style-type: none"> • Exercises on the preparation of location specific models and eco-tourism plans. Interactions with local governing bodies. 	0+3
<ul style="list-style-type: none"> • Feasibility studies-economic, social and environmental. Exercises on environmental impact assessment. Economic valuation of natural resources. Economic based case studies of important tourism destinations. Exercises on tourism capacity building and assessment 	0+3
<ul style="list-style-type: none"> • GIS based mapping of major ecotourism destinations. 	0+3
<ul style="list-style-type: none"> • Assessment of ecotourism potential and carrying capacity. Designing of suitable ecotourism activates. Identification of the ecosystems where climate change has its impact on tourism potential . Evaluation and monitoring of different ecotourism activates. 	0+2
<ul style="list-style-type: none"> • Project report and submission. 	0+2
Total	0+20

5. ENV-630 ENVIRONMENTAL IMPACT ASSESSMENT Cr. 20(0+20)

Activity	Credit
<ul style="list-style-type: none"> Basic concepts of Environmental Impact Assessment (EIA). Approaches for developing list of environmental factors. Assessment of pre-project, operational and post project environment impacts. 	0+2
<ul style="list-style-type: none"> Methods of EIA. Evaluation efficiency of different methods using comparative studies. 	0+1
<ul style="list-style-type: none"> Measurement techniques and tools of air, water, soil, thermal and nuclear pollution. 	0+2
<ul style="list-style-type: none"> Predication and assessment of impact on air, water, noise, biological and social environment. 	0+2
<ul style="list-style-type: none"> Public participation and preparedness in environmental decision-making. Preparation of environmental management plans. 	0+2
<ul style="list-style-type: none"> Types of environmental and social green critical and general approaches. Audit team, preparation of audit report, analysis and performance and emergency preparedness. 	0+2
<ul style="list-style-type: none"> Environmental safety, disaster management, risk management and emergency preparedness. 	0+2
<ul style="list-style-type: none"> Basic Total Quality Management (TQM), national and international organizations for standardization (BIS/ISO): duties and functions. 	0+2
<ul style="list-style-type: none"> Different environmental legislations: Environmental Protection Act 1986, Air Act 1981, Water Act 1974, Anti dumping legislations and others-case studies 	0+3
<ul style="list-style-type: none"> Project report, writing and presentation 	0+2
<ul style="list-style-type: none"> 	
Total	0+20

SEMESTER – VIII

MULTIDISCIPLINARY COURSE / VOCATIONAL TRAINING Cr. 20 (0+20)

S.No.	Course Code	Subject	Credit
1	SVC-699	Forest Project/ Industrial Placement/ Institutional Attachment	10 (0+10)
2	FBL-500	Study Tour	6 (0+6)
3	AGF-698	Forest Work Experience	4 (0+4)
Total credits			20 (0+20)

SVC-699 FOREST PROJECT / INDUSTRIAL PLACEMENT / INSTITUTIONAL ATTACHMENT Cr. 10(0+10)

The students will be divided into various groups comprising 3 students per group based on alphabetical order of their respective name. Each group will be assigned a forest project. Each staffs in College of Forestry will guide the assigned group of students. After the completion of the project, the students should prepare a Project Report including, Project Objectives, Materials & Methods, Review of Literature, Results & Discussion and Pictorial Documentation of the project. One of the students must present the project in front of the Project Co-ordinator for final evaluation.

The forest project may be on,

- Short term research programme in forestry
- Forest or wood based industries
- Forest resources
- Forest or wildlife management
- Forest economics
- Tribal welfare
- Agroforestry
- Social forestry
- Forest Soils
- Assessment of pest or disease incidence
- Wood technology or Wood preservation methods
- Floristic Composition and Forest types
- Nursery Operations and management
- Soil and water conservation measures
- Forest Genetics & Tree Breeding
- Transfer of Technology

Evaluation Procedure

Project Report	50.00
Individual Contribution	20.00
Project Presentation	30.00
Total	<hr/> 100.00 <hr/>

FBL-500

STUDY TOUR

Cr. 6(0+6)

Study tour to various Forest areas - Forest plantations - Forestry, Agricultural and Horticultural Institutes - Reputed Government and Non-Governmental Organizations for Forestry, Environmental and Wildlife Conservations – National Parks – Wildlife Sanctuaries – Zoological Parks – Botanical Gardens – Forest based Industries – Wood based Industries – Tribal Welfare Programme areas – Social forestry divisions - Joint Forest Management areas

AGF-698

FOREST WORK EXPERIENCE

Cr. 4(0+4)

Syllabus

Forestry Work Experience Programme for a period of 105 days in different forest divisions of Uttar Pradesh. Tour of five students per division– the division will be allotted by the Uttar Pradesh Forest Department. Students cover all the ranges in the division. Appraisal of the various aspects of range administration, resource management, wildlife management, tribal welfare, Agroforestry and social forestry programmes, soil and water

conservation measures – tackling illicit poaching and tree cutting – census of wildlife -
fire management, silvicultural practices – detailed study of working plan in the division –
maintenance of daily records, submission of herbaria, seed samples – participatory rural
appraisal exercises in field.

Evaluation Procedure

Field note book	20.00
Report preparation	20.00
Herbarium & Seed samples	10.00
Attendance	20.00
Sincerity	10.00
Viva-voce	20.00
Total	<hr/> 100.00 <hr/>